LAME

water and sewer systems study

New Well sites: p 82, 93

Relationship of wells and sewage facilities to flood plains is made only on page 82.

LAKE MEAD

Because [illegible] algae call for expensive water treatment of Lake Mead water before use, i.e. the use of sand fiters, perhaps at some future time we should consider

NATIONAL RECREATION AREA
NEVADA-ARIZONA

trying an experiment of building a sand bar in the lake with large diameter well casing placed with bar construction. If the bar would serve as a filter for a long time, much money could be saved.

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LAKE MEAD WATER AND SEWER SYSTEMS STUDY

Lake Mead National Recreation Area

Package 587

November 1990

Debra Campbell, P.E.
Environmental Engineer, Western Team
Denver Service Center
National Park Service

NATIONALPARK SERVICE

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ABBREVIATIONS

con't	continued
cf	cubic feet
cfm	cubic feet per minute
ft.	feet
gpd	gallons per day
gpm	gallons per minute
hp	horsepower
mg	million gallons
mgd	million gallons per day
mins.	minutes
ntu	Nephelometric Turbidity Units
ppb	Parts per Billion
ppm	Parts per Million
sq. ft.	square feet
SOC	Synthetic Organic Compounds
tdh	total dynamic head
VOC	Volatile Organic Compounds

EXECUTIVE SUMMARY AND RECOMMENDATIONS

This study was completed at the request of the Lake Mead National Recreation Area (NRA) staff. The operation and maintenance of the water and wastewater systems within the recreation area have been significantly impacted by increased visitation during the previous decade. In addition, the recent Amendments to the Safe Drinking Water Act (SDWA) will require additional contaminant testing to monitor maximum contaminant levels. The study addresses the water and wastewater systems at each of the nine developed areas as well as one primitive area. The total cost of the recommended utility improvements for Lake Mead National Recreational Area is $12,871,000. Wastewater system improvements account for $8,230,000, or 64% of the total. Water system improvements account for $4,641,800, or 36% of the total. All net construction cost estimates are based on the Denver Service Center Class C Estimate Schedule and the 1990 Means Construction Data. The cost reflect the construction climate through FY 91

TABLE 1

RECOMMENDED WASTEWATER AND WATER IMPROVEMENTS
COST SUMMARY
LAKE MEAD NATIONAL RECREATION AREA

AREA	WATER	WASTEWATER
Boulder Beach	$ 220,000	$ 258,000
Las Vegas	213,000	603,000
Callville Bay	255,000	2,338,000
Echo Bay	2,410,000	439,000
Overton Beach	39,000	30,000
Temple Bar	155,000	1,295,000
Willow Beach	735,800	1,131,000
Katherine	142,000	1,010,000
Cottonwood	297,000	1,126,000
Shivwits	175,000	-0-
	$4,641,800	$8,230,000

Wastewater system improvements include upgrades to the collection system, treatment facility, and final disposal site. The majority of the recommended improvements to the wastewater system relate to expanding treatment capacity at Callville Bay, Las Vegas Wash, Cottonwood Cove, Katherine, Willow Beach, and Temple Bar. The estimated construction cost for new facilities or modification of existing wastewater facilities totals $ 6,836,000. Recommended improvements to the sewage collection system total $1,234,000. A majority of this work includes replacement of antiquated sewage lift stations at Las Vegas Wash, Echo Bay, Cottonwood Cove, and Willow Beach. Minor upgrades to sewage disposal facilities are recommended at Boulder Beach, Katherine, Willow Beach, and Temple Bar. These improvements total $160,000.

Water system improvements include raw water diversion, treatment, potable storage, and distribution. The majority of water system improvements are treatment upgrades at Echo Bay and Willow Beach. The recommendations are related to increasing treatment capacity and enhancing process reliability. The recommended improvements total $2,092,000. The next largest portion of construction dollars is required to expand water storage facilities at Las Vegas Wash, Callville Bay, Echo Bay, and Willow Beach. Additional water storage should in no way hinder conservation efforts in the park, particularly, those related to irrigation. Construction of a storage tank at Echo Bay is recommended over repairs to the existing maintenance-intensive hydropnuematic system. Total cost for increasing the Lake Mead treated water storage capacity is $1,787,000. Raw water diversion facilities at Callville Bay, Echo Bay, Overton Beach, and Katherine are in need of repair or replacement. Estimated cost of this work is $660,000. Upgrades in the water distribution systems at Boulder Beach and Katherine total $102,000.

Overall, the top priorities include:

- The number one park priority is construction of a 2.7 acre lagoon at Callville Bay. The wastewater facility has been cited for noncompliance by the Nevada Division of Environmental Protection. This project will also include relocation of the force main, replacement of the sewage lift station, grading/revegetation of the existing site, and purchase of a portable generator. This project, referred to as CBWW1, has an estimated construction cost of $2,200,000.

- The second priority is to expand capacity of the Las Vegas Wash Sewage lagoons; this is referred to as LVWW1. The existing lagoons have been cited for noncompliance by the Nevada Division of Environmental Protection. Adjacent, unused lagoons can be used for the expansion at an estimated construction cost of $440,000.

- The third park priority is expansion of the Willow Beach sewage lagoons. The sewage lagoons periodically overflow; disposal at the spray field is unacceptable due to recent changes in regulations for land application of wastewater implemented by the State of Arizona. The project is referred to as WBWW1. Estimated construction cost of increasing the lagoon area at the existing site is $830,000.

- The fourth Park priority is to construct four items to improve water treatment and storage capabilities at Las Vegas Wash. Estimated construction cost of the connection is $213,000.

The recommended improvements have been prioritized by area. Each recommended project has been identified by area, type of utility, and order of priority. For example, BBW1, refers to the Boulder Beach water system recommended improvement, priority number one. Recommendations for water system upgrades are summarized in Table 2; a similar listing for the wastewater system improvements is provided in Table 3. The projects are ranked by both the need for equipment replacement and potential health hazard in Tables 2 and 3 for water and wastewater improvements, respectively. The individual projects have been ranked on the basis of replacement needs as well as the present situations' health risks.

TABLE 2
SUMMARY OF RECOMMENDED WATER SYSTEM IMPROVEMENTS

PROJECT NO.	DESCRIPTION	ESTIMATED CONSTRUCTION COST	REPLACEMENT PRIORITY	HEALTH HAZARD PRIORITY
BBW1	Connect the VC to Boulder City.	$ 70,000	17	29
BBW2	Upgrade the water treatment plant.	130,000	6	14
BBW3	Internal inspection of all water tanks.	20,000	29	28
LVW1	Modify chlorine solution make up water piping.	8,000	5	1
LVW2	Construct 0.015 MG flocculation basin.	30,000	15	2
LVW3	Construct a 0.110 MG water tank.	170,000	14	3
LVW4	Inspect interior of existing water tank.	5,000	26	27
CBW1	Construct 0.080 MG water storage tank.	160,000	16	7
CBW2	Replace raw water intake barge.	85,000	10	13
CBW3	Internal inspection of water tank surface.	10,000	27	26
EBW1	Replace raw water intake barge.	85,000	8	10
EBW2	Construct new filter plant.	1,900,000	7	4
EBW3	Construct new water storage tank.	425,000	19	21
OBW1	Repair/replace raw water intake pumps.	30,000	11	12
OBW2	Frost protection for automatic valves.	9,000	12	20
CCW1	Construct 0.10 MG water tank.	272,000	18	19
CCW2	Inspect interior surface of the existing water tanks.	10,000	28	25
CCW3	Relocate desander.	15,000	20	18
KW1	Replace raw water intake barge.	85,000	9	11
KW2	Inspect interior of existing tank; repaint exterior surface.	25,000	21	24
KW3	Install hydrant at campground.	16,000	24	8
KW4	Install hydrant at Maintenance facility.	16,000	25	9
WBW1	Relocate water storage tank.	575,000	2	17
WBW2	Relocate well and pump stations.	160,000	1	6
TBW1	Replace stand by pump.	30,000	4	15
TBW2	Add lightening protection to well house.	10,000	13	16
TBW3	Repaint exterior of water storage tank;inspect interior.	55,000	22	23
TBW4	Construct access road to water tanks.	60,000	23	22
SPW1	Construct new well and pump house.	175,000	3	5

NOTE: The specific area for each of the recommended water (W) improvement project is designated with as follows: Boulder Beach - BB; LV - Las Vegas Wash; CB - Callville Bay; OB - Overton Beach; CC - Cottonwood Cove; K - Katherine; WB - Willow Beach; TB - Temple Bar; and SP - Shivwits Plateau.

TABLE 3

SUMMARY OF RECOMMENDED WASTEWATER SYSTEM IMPROVEMENTS

PROJECT NO.	DESCRIPTION	ESTIMATED CONSTRUCTION COST	REPLACEMENT PRIORITY	HEALTH HAZARD PRIORITY
BBWW1	Replace campground sewage lift station with new suction lift type station.	$ 138,000	9	12
BBWW2	Replace VC soil absorption field and install a dosing tank.	120,000	10	21
LVWW1	Expand sewage lagoons.	440,000	4	2
LVWW2	Replace main sewage lift station.	138,000	7	13
LVWW3	Purchase emergency generator.	25,000	14	19
CBWW1	Construct new sewage lagoons.	2,200,000	3	1
CBWW2	Replace campground sewage lift station.	138,000	11	20
EBWW1	Replace all three sewage lift stations.	414,000	1	10
EBWW2	Purchase potable generator.	25,000	15	18
OBWW1	Modify magnetic flow meter.	5,000	13	22
OBWW2	Purchase portable generator.	25,000	16	17
CCWW1	Replace both sewage lift stations.	276,000	2	9
CCWW2	Reconfigure sewage lagoons.	875,000	22	8
CCWW3	Purchase portable generator.	25,000	17	16
KWW1	Construct 1.2 acre lagoon.	990,000	12	5
KWW2	Enclose percolation lagoon.	20,000	20	7
WBWW1	Construct 1.0 acre lagoon.	830,000	5	3
WBWW2	Replace two sewage lift stations.	276,000	6	11
WBWW3	Purchase emergency generator.	25,000	18	15
TBWW1	Construct 1.5 acre lagoon.	1,250,000	8	4
TBWW2	Enclose percolation lagoon with a fence.	20,000	21	6
TBWW3	Purchase an emergency generator.	25,000	19	14

NOTE: The specific area for each of the recommended wastewater (W) improvement project is designated with as follows: Boulder Beach - BB; LV - Las Vegas Wash; CB - Callville Bay; OB - Overton Beach; CC - Cottonwood Cove; K - Katherine; WB - Willow Beach; TB - Temple Bar; and SP - Shivwits Plateau.

GENERAL STUDY OVERVIEW

OBJECTIVE

The objective of this study was to evaluate the existing water and wastewater facilities at Lake Mead National Recreation Area. The water distribution and sewage collection systems were installed as early as the 1950's. Most of the water treatment plants and sewage lagoons being operated today were constructed in the late 1960's.

It was noted that many plants are now operating at or over capacity and, in several cases, are out of compliance with the state and federal regulations.

The developed areas covered in this study include: Boulder Beach, Las Vegas Wash, Callville Bay, Echo Bay, Overton, Temple Bar, Willow Beach, Katherine Landing, and Cottonwood Cove. One undeveloped area, a primitive fire camp located on the Shivwits Plateau, has also been included in the study.

Each area's utilities were evaluated based on information gathered during site investigations or obtained through interviews with Lake Mead Staff. A review of equipment information, historical data, and operations and maintenance files was completed at the park.

INTRODUCTION

Lake Mead National Recreation Area comprises 650 miles of shoreline and 297 square miles of water including both Lake Mead and Lake Mohave. Both lakes were formed after construction of dams on the Colorado River. The backwater from Hoover Dam forms Lake Mead;the backwater of Davis Dam forms Lake Mohave. A site plan of the recreation area is shown on page 8.

Visitation to the recreation area increased from 6 million tourists in 1979 to 8.803 million visitors in 1989. The largest share of visitors is from the Las Vegas metropolitan area. According to recent demographic studies, the Nevada population has grown 40% in the last decade. Attracted by the water recreational opportunities, Lake Mead NRA offers the visitor scenic views and activities such as swimming, camping, hiking, boating, and fishing.

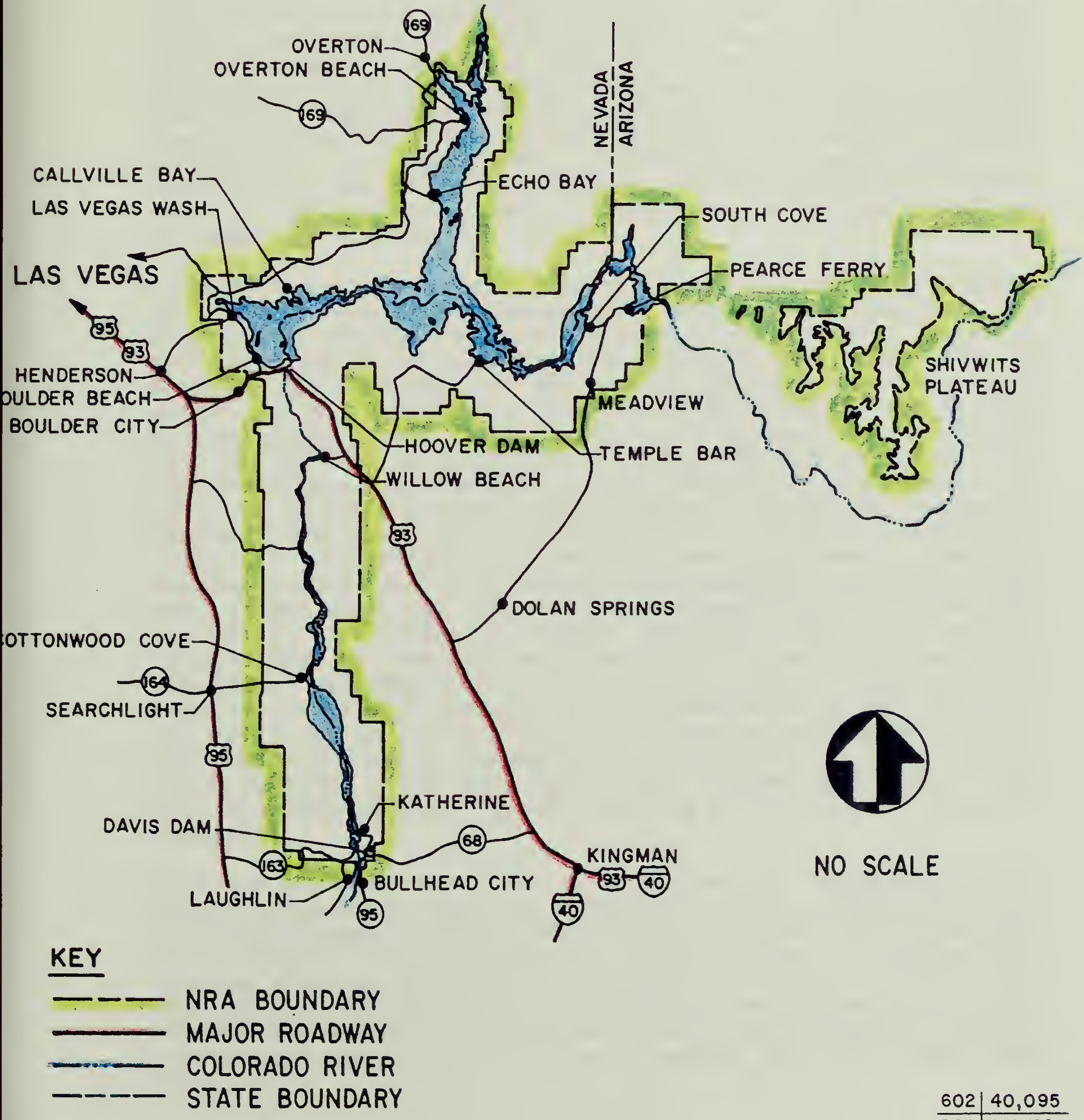
Lake Mead NRA is situated in an arid desert. Annual precipitation is less than seven inches. Late summer-early fall thunderstorms often cause flash flooding in the shoreline canyons. Extreme temperatures above 110 F are typical during the summer months. Winter temperatures are rarely below 32°F. Humidity ranges between 25-28%. Evaporation rates average 90 inches annually with maximum rates often in excess of 110 inches per year.

The park does not limit access in the recreational area. Paved roads are provided to each of the nine developed areas. Many unpaved, unimproved roads offer the visitor access to remote sectors of the recreational area.

Marina facilities were initially established at the nine developed locations around the lake to monitor access, encourage recreational use of the lake, and promote visitation to the recreation area. Later, service related businesses such as restaurants and lodges were developed at the marinas to support the thriving visitation. In addition, permanent trailer sites were allowed to stimulate year round visitation. Private residences were constructed just east of Temple Bar, north of Katherine, and at Stuart's Point, located between Echo Bay and Overton. The homes were constructed on leased property. Strict restrictions govern the occupancy and resale rights.

SITE PLAN

LAKE MEAD NATIONAL RECREATION AREA



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OVERVIEW: WATER SUPPLY AND TREATMENT

Water is the primary resource at the recreation area. Sources for both domestic and recreational use are readily available. Lack of water has not restricted development. Both surface and groundwater sources are used for potable water at the recreational area. The Ten State Standards were used for evaluation of facilities used for water and wastewater facilities at Lake Mead NRA. Surface water is used at Boulder Beach, Las Vegas Wash, Callville Bay, Echo Bay, Overton Beach, and Katherine. Water is treated by sedimentation, filtration, and chlorine disinfection to meet current drinking water standards. Chemicals are not used to enhance taste and odors; however, high molecular weight polymers are used to enhance settling at some locations. Disinfection is accomplished by injecting a gas chlorine solution. Desired chlorine contact time is achieved using both contact basins at the plant and storage tank capacity.

Groundwater aquifers are pumped to provide water at Temple Bar, Willow Beach, Cottonwood Cove, and Shivwits Plateau. The groundwater quality at these areas is excellent. Water is monitored daily by Park Service staff; annual water quality samples are submitted to the local health department. All water sources currently meet drinking water regulations according to these test reports. A summary of the water quality at each development is summarized in Table 4. The 1986 Amendments to the Safe Drinking Water Act will impact the park, as it has most small water systems throughout the United States. The park will be required to monitor an increased number of contaminants and report these findings. Mandatory maximum contaminant levels (MCL) and compliance schedules have been established for the various systems defined by the SDWA including: Community Water Systems with 15 service connections or regular service to at least 25 year-round residents; Non-Transient, Non-Community Water System which regularly serves at least 25 of the same persons over 6 months per year, but is not a community water system; and Transient, Non-Community Water System which includes all other public water systems. All Lake Mead water systems evaluated, with the exception of Shirwits Plateau, are classified as community systems.

Two of the new contaminants to be tested for include volatile organic compounds (VOC) and synthetic organic compounds (SOC). Increased levels of VOC's and SOC's have been associated with an increased risk of cancer. Non-transient, non-community systems will be required to report VOC's by the end of 1991. Preliminary testing of VOC'S at Katherine indicates that the surface water source will be well below the minimum allowable concentrations. No preliminary testing for SOC's has been done.

WATER QUALITY SUMMARY
LAKE MEAD NATIONAL RECREATION AREA

PARAMETER	KATHERINE	TEMPLE BAR	WILLOW BEACH	BOULDER BEACH	ECHO BAY	LAS VEGAS WASH	COTTONWOOD COVE	CALLVILLE BAY	OVERTON BEACH	MCL
Arsenic	<0.02	<0.02	<0.003	0.003	<0.003	<0.003	<.003	<0.003	<0.003	0.05 (1)
Barium	0.1	<0.1	0.1	0.09	0.10	0.10	.050	0.09	0.09	1.0 (1)
Cadmium	<0.005	<0.005	<0.005	--	--	--	.005	--	--	0.010 (1)
Chronium	<0.02	<0.02	<0.0	--	--	--	.00	--	--	0.05 (1)
Fluoride	0.2	0.6	0.27	0.28	0.29	0.29	.15	0.29	0.28	4.0 (1) 2.0 (2)
Lead	<0.02	<0.02	<0.02	--	--	--	<.030	--	--	0.05 (1)
Mercury	<0.001	<0.002	<0.001	--	--	--	<.001	--	--	0.002(1)
Nitrates	<0.5	1.3	<0.5	2.2	1.4	2.4	8	1.3	2.0	10.0 (1)
Seleium	<0.005	<0.005	<0.005	--	--	--	<.005	--	--	0.01 (1)
Silver	<0.02	<0.02	<0.02	--	--	--	<.030	--	--	0.05 (1)
Alkalinity	120	100	180	126	126	128	--	106	126	HA
Calcium	72	79	87	65	67	65	90	61	66	HA
Chloride	20	81	94	56	54	54	184	65	63	250
Copper	<0.05	<0.05	<0.05	0	0	0	<.02	0	0.09	1 (2)
Hardness	290	260	320	261	266	261	310	259	264	HA
Iron	<0.1	<0.1	<0.1	0	0	0.01	.020	0.04	0.17	0.3 (2)
Magnesium	27	16	25	24	27	24	21	26	24	HA
Manganese	<0.05	<0.05	<0.05	0	0	--	--	--	0	0.05 (2)
pH	7.6	7.6	7.5	8.8	8.48	--	8.1	--	8.08	6.5-8.5 (2)
Sodium	78	110	150	74	73	71	236	78	74	HA
Sulfate	320	270	310	214	214	209	391	236	211	260(2)
Total Disolved Solids	580	670	790	545	550	545	1030	572	553	500 (2)
Carbonate	<5	<5	0	10	0	0	0	10	0	HA
Potassium	3.9	3.6	6.1	3	3	3	6	4	4	NA
Conductivity	850	1000	1200	--	--	--	1690	--	--	NA
Bicarbonate	<5	<5	<5	154	134	156	189	110	154	HA
MBAS-Surfactants	<0.05	<0.05	--	--	--	--	--	--	--	HA
Zinc	<0.05	<0.05	<0.05	0.19	0	0.02	.11	0.04	0.07	5 (2)

NOTE: All unites in mgle except for hardnes, conductivity and pH. Primary MCL's denoted by (1). Secondary MCL's denoted by (2).

Fluoride concentrations above the MCL's have occurred in the past at Cottonwood Cove. The well where the high levels were measured has since been abandoned and replaced with a new well. According to the current water quality data, the fluoride levels at Cottonwood Cove and the other developments remain below the maximum contaminant level (MCL). The park has historically met the MCL's of the other nine inorganic contaminants being monitored. Thirteen new inorganic contaminants are to be reported; several presently being monitored by the park are well under the proposed MCL.

Coliform results from the surface water intakes are typically negative. All potable water intakes are located away from the swim beaches, in isolated coves. Quarterly raw water samples indicate that turbidity concentrations from both surface and groundwater sources are extremely low. Erratic influent turbidity has been noted at Echo Bay and appears to be related to the influence of seasonal fluctuations in water levels at that specific site.

Seasonally high influent turbidity at Overton Beach appear to be related to the ongoing nutrient program sponsored by the Nevada Division of Fish and Wildlife aimed at enhancing fish life in the Overton arm of Lake Mead. New turbidity MCL's are directed at improving particle and microbial removals, as well as reducing the potential for interference with disinfection. The existing conventional filtration plants will provide adequate treatment at all areas except for Las Vegas Wash and Echo Bay based on plant operation data. Limitations of each existing system will be individually, addressed, along with recommended modifications to enhance the current treatment.

Disinfection by-products, trimetholhalomethanes (THM), will be limited to 100 micro-gram/liter for large systems; however, reduction of the limit to 50 micro-gram/liter for all systems may be required by the end of 1993. The park will not be required to comply with this regulation since all systems serve populations less than 10,000.

Although radionuclides are not typically monitored in a non-community system, because of the geology of the area, it would be advisable for the park to periodically monitor the level of the five radionuclide contaminants.

The typical water costs for potable water treatment were developed for use in life cycle cost comparisons for this study only. These costs were based on labor, equipment and material costs furnished by park staff. The costs do not include amortized capital cost of the various facilities (pumps, pipelines, etc.) and do not reflect billable rates or water rate structures for a specific area by Lake Mead staff. These costs are summarized per area on page 12.

LAKE MEAD N.R.A. - WATER TREATMENT COSTS

Development	Annual O&M Costs (1)	Total Water Flow (2)	Unit Cost $/1000 Gallons (3)
Boulder Beach	$113,714	164.3	$ 0.69
Las Vegas Wash	100,086	26.5	3.77
Callville Bay	77,214	30.4	2.54
Echo Bay	117,753	53.8	2.19
Overton Beach	121,410	5.5	22.07
Temple Bar	70,217	78.5	0.90
Willow Beach	70,326	24.2	2.91
Katherine	125,359	90.9	1.38
Cottonwood Cove	74,619	99.4	0.75

(1) Based on actual operating and maintenance costs recorded by Lake Mead staff.

(2) Based on pump records presented in million gallons.

(3) Calculated by dividing annual operating and maintenance costs by annual usage.

The high unit costs for Overton Beach are a reflection of the preventive maintenance completed on the control system at treatment plant, as well as construction of staff housing and a campground.

Based on visitor records, per capita water use for the area ranges from a low of 145 gallons per capita per day (gpcpd) at Overton Beach to a high of 520 gpcpd at Boulder Beach. The per capita water use was calculated using park visitation and water pumpage records. The purpose of this computation is to illustrate the relatively high water use throughout the recreation area.

Refer to Table 6 for a summary of per capita water use throughout the area. For comparison purposes, water use for Las Vegas was 350 gpcpd in 1988.

TABLE 6
LAKE MEAD PER CAPITA WATER USE

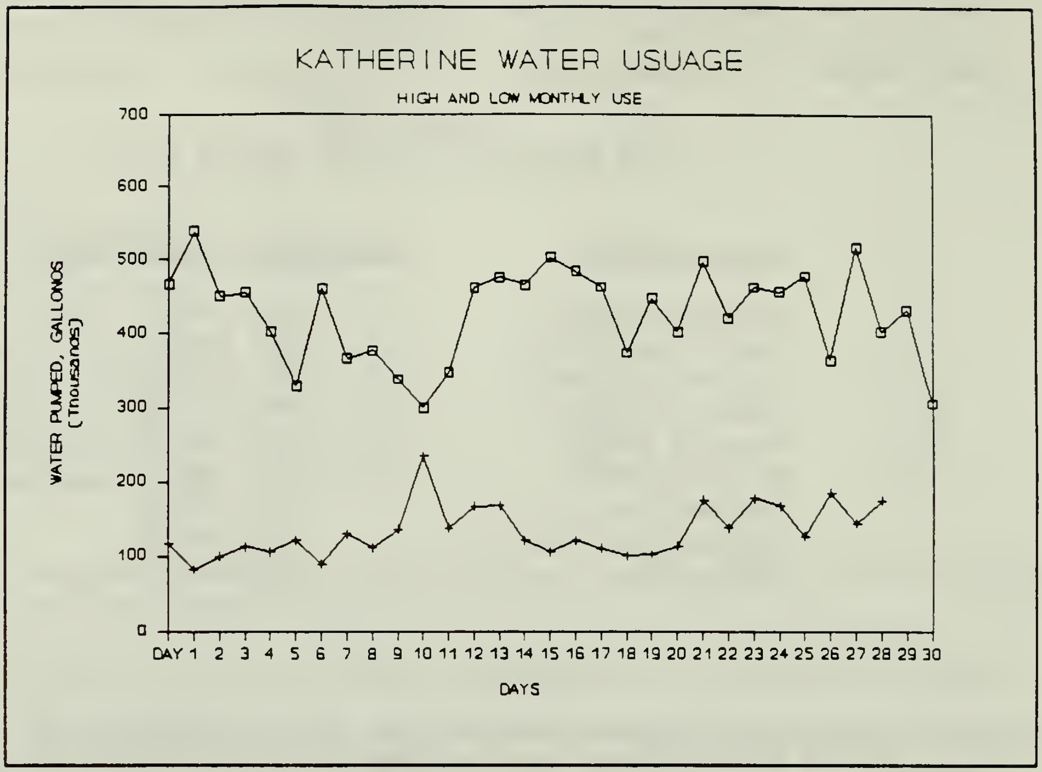
Development	Estimated Water Use
Boulder Beach	520 gpcpd
Las Vegas Wash	320 gpcpd
Callville Bay	220 gpcpd
Overton Beach	145 gpcpd
Temple Bar	455 gpcpd
Willow Beach	320 gpcpd
Katherine	460 gpcpd
Cottonwood Cove	510 gpcpd
Echo Bay	505 gpcpd

This high per capita water use is attributed to the large amount of water used for irrigation throughout the developed areas. Irrigation is required to maintain the abundant, rich foliage exotic to the arid, desert environment. The vegetation provides the protection from the intense heat that the Lake Mead visitors find appealing.

The tremendous amount of water used for irrigation is clearly shown on page 14, which depicts differences in seasonal water usage at a typical development at Lake Mead. Average water use in November is 150,000 gpd while during the irrigation period, water usage jumps to over 425,000 gpd.

Comparing both water and wastewater records indicates that all except one area use between 80 and 90 percent of the treated water for irrigation annually. The exception to this trend in water usage was Overton Beach, which has significantly less vegetation than the other eight developed areas.

FIGURE 4 - TYPICAL SEASONAL WATER USAGE AT LAKE MEAD



All areas provide adequate capacity for fire storage; however storage capacity is significantly impacted by the amount of treated water used for irrigation during periods of peak visitor use. The park irrigates by flooding open ditches located adjacent to the vegetated sections of the development. A tremendous amount of water is lost through evaporation in this inefficient, non-conserving system. As a result of the high water usage, many areas, including Cottonwood Cove, Willow Beach and Las Vegas Wash have a limited amount of treated water storage capacity.

The most significant impact for water conservation within the recreation area would be to replace this system with an underground system. Applying conservative referenced values, the water savings could be as great as 75%. Consider that Lake Mead NRA treated approximately 575 million gallons of water in 1988. Irrigation accounts for approximately 80% of the water use, or 460 million gallons. One option for reducing water use would be to use nonpotable water for irrigation. This type of system would required separate storage and distribution facilities. Although this is desirable, the park has little economic incentive to switch to such a system due to the availability of the water the relatively low cost of treatment.

Presently, development utilizes a separate potable source for domestic use and a nonpotable water source for irrigation and fire flows. Park management supports dual plumbing for irrigation, fire fighting, toilets, and maintenance; however, critics of two separate systems warn of the potential health risks of cross connections between the two systems. Proper facilities information management and cooperation with the concessioner would preclude such a problem. Estimated construction cost for complete separation at all nine facilities would be $14,300,000.

Another viable option to reduce the amount of potable water used for irrigation would be through a separate underground drip emitter system. This would be less expensive to construct, estimated at $3,800,000.

Another method by which the park could increase water conservation would be to retrofit all park facilities with low volume fixtures. This would include installation of low flush toilets using approximately 1.6 gallons per flush and low flow shower heads that deliver a flow less than 3 gpm. The same should be required of the concessioner. A practical approach to implement water conservation with low water fixtures would be to set aside a fixed amount annually for the replacement of existing fixtures, requiring the same of the concessioner. Park management agrees that this is a viable option. Retrofitting fixtures where practical and installing low water use fixtures for new construction will contribute to the goal of water conservation.

OVERVIEW: WASTEWATER COLLECTION, TREATMENT, AND DISPOSAL

Shoreline development is characteristic at Lake Mead. Small diameter collection systems presently serve all existing park and concessioner operated facilities. Extension of the collection system will be required if proposed development at Katherine, Boulder Beach, Las Vegas Wash, and Willow Beach proceeds as planned.

Lake Mead staff maintains twenty operating pump stations. Several of the lift stations are antiquated and operating above their rated capacities. The older stations are flooded suction pumps, most located in belowground "packaged" containers. Confined space entry procedures of the industry are often overlooked by staff. This dangerous practice poses risks to these people and the National Park Service. Another deficiency noted during the study was the lack of portable atmosphere monitoring equipment. These units are relatively inexpensive, and can provide invaluable information to the maintenance personnel working in confined spaces.

Most of the newer pump stations contain suction lift style pumps. Although Park Service designers recommend against the use of a suction lift type pump, the actual operating record and park staff preference should be considered. The suction lift type station used at Lake Mead has an outstanding record of equipment reliability. Preventive and cyclic maintenance requirements have been minimal, and replacement parts have been easily obtained. Well designed and properly installed suction lift stations are as reliable and inherently safer than the belowground type lift stations.

Limited emergency power is available at the individual developments. Portable, auxiliary power generators are available at both Boulder Beach and Katherine. Units are needed at every development to provide the isolated areas temporary power due to the frequent outages. Each developed area should retain a portable emergency generator on site to provide emergency power.

Park staff measures sewage at each main lift station at six areas. An elapsed time meter totals daily pump run time. The method, although reliable, is not useful for monitoring diurnal variations. Although methods of flow measurement would provide more detailed and accurate recordings, routine preventative maintenance required for accurate operation would significantly impact the park's limited staff and annual maintenance budget. It will be recommended that the park convert to a true event recorder to monitor the diurnal pumping rates. The park staff supports the use of this type of equipment.

Treatment and disposal are in sewage lagoons located above the lake and shoreline development. This flatter terrain provides sufficient land area. Construction costs are reduced, and these locations offer adequate buffer zones between the development. The negative aspect of this uphill location is that all sewage must be pumped up to the lagoons at all nine areas.

Biological stabilization lagoons are used for final treatment at all nine developed areas. The biological activity is enhanced by mechanical aeration at six of the areas. Stabilization lagoons efficiently treat the wide range of flows and organic loads typical of seasonal visitation at the individual developments.

The wastewater is disposed primarily by evaporation. Evaporative disposal is ideal in this arid environment where the net evaporation averages over 90 inches annually. At several areas, a final percolation pond is used in combination with evaporation for disposal.

Lagoons can be operated with wide variations in flows and loadings with minimal operation and maintenance. Weekly control tests monitor dissolved oxygen, ph, temperature, and liquid depth. Quarterly samples for biochemical oxygen demand and suspended solids are required for the facilities under the jurisdiction of the Nevada Environmental Protection Division.

Lagoons for treatment and disposal are normally operated at a low cost per unit of treated wastewater as summarized in Table 7. These costs were based on labor, equipment and material costs furnished by park staff. These costs do not include amortized capital cost of the various facilities (pumps, pipelines, etc.) and do not reflect billable rates or water rate structures for a specific area. These costs are applicable to the comparison made for the purposes of the study only.

TABLE 7

LAKE MEAD N.R.A. - WASTEWATER TREATMENT COSTS

Development	Annual O & M Treatment Costs (1)	Annual Sewage Flow (2)	Unit Cost $/1000 Gallons (3)
Boulder Beach	$ 78,915	18.25	$ 4.32
Las Vegas Wash	40,208	1.83	22.03
Callville Bay	73,567	9.12	8.06
Echo Bay	76,698	9.13	8.40
Overton Beach	76,653	2.92	26.25
Temple Bar	73,985	8.85	8.35
Willow Beach	77,735	3.87	20.07
Katherine	78,879	10.12	7.80
Cottonwood Cove	79,365	9.86	8.05

(1) Based on labor, power, equipment, and material costs for each development.

(2) Based on pump records for all areas except Katherine, Temple Bar, and Willow Beach; shown in million gallons.

(3) Calculated by dividing annual O&M costs by annual flow.

The higher costs at Las Vegas Wash and Willow Beach reflect the emergency and preventative maintenance required for the lift stations at those areas. The high costs for Overton Beach reflect the labor and materials spent by the park to install staff housing and a campground.

BOULDER BEACH

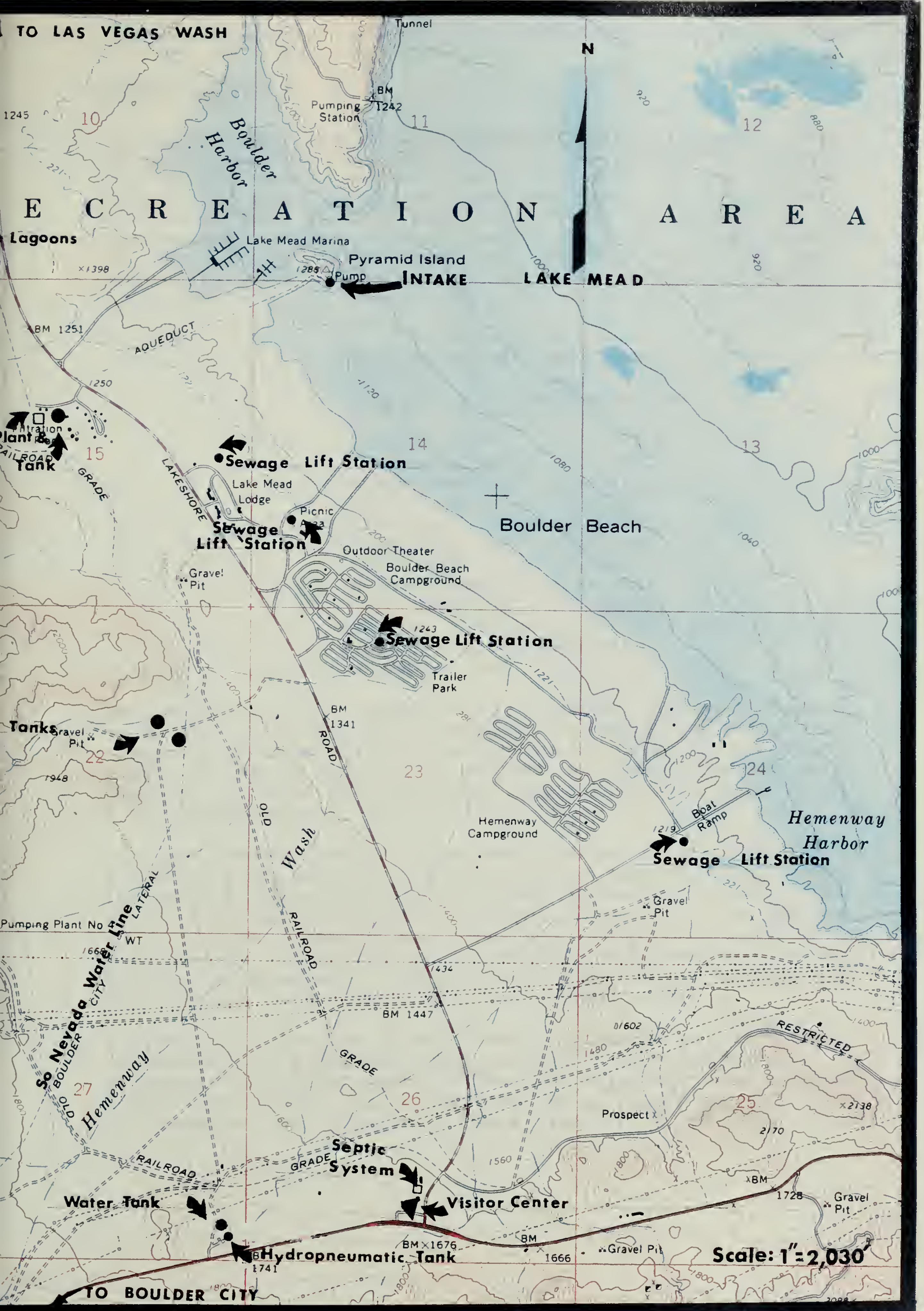
SITE DESCRIPTION

Boulder Beach is located on the western shoreline of Lake Mead, approximately 3 miles from Boulder City and 20 miles from Las Vegas. Boulder Beach is one of the most popular day use areas in the NPS. According to park records, visitation is estimated at 354 people per day. The area is easily accessed from US-93 by Lakeshore Drive. Facilities maintained by the NPS at Boulder Beach include Lake Mead Marina, Boulder Beach, Hemenway Beach, and the Allen Bible Visitor Center. All except the Visitor Center are located on the shoreline.

Lake Mead Marina consists of a store, restaurant, and marina. According to park records,visitors to the Lake Mead marina come from more points of origin than do visitors to any other developed area within the NRA. The spot is convenient for transient population who desire a "quick" trip of the lake and dam through the charter boat service of 35 individual and 4 tour boats at the marina.

The Lake Mead Marina provides overnight and dry dock boat storage. The dock structure has 400 permanent slips and potential for future expansion to 875 slips. The Park Service maintains 7 slips for park boats. All the facilities are constructed on sections of stationary and floating dock. Wastewater is collected from the dock and pumped back to the main Boulder Beach collection system. The park provides 16 permanent residences for staff near the Lake Mead Marina. These are served with potable water and waste is collected via the common gravity system.

Boulder Beach is a 10-acre mixed activities beach with a swim beach, store, Lakeshore Trailer Village, and Lake Mead Lodge. Boat launching and overnight and day use facilities are available here. The Lake Mead Lodge is a 44-unit motel. A 56-site picnic area is provided for day use. A 338-site campground maintained by the park is reserved for tents, trailers, and recreational vehicles. The concessioner operates a trailer village for 215 long term sites and 75 short term sites. Hemenway Beach, located at the southern edge of the development, consists of a campground, launch ramp, and events center. The campground has 184 campsites. A launch ramp provides easy access to the lake. The Allan Bible Visitor Center is located approximately 2 miles south of the Boulder Beach development on the main highway to Hoover Dam, US-93 the Visitor Center attracts a significant number of visitors passing through the recreation area.


TO LAS VEGAS WASH
Tunnel
N
Pumping Station
BM 1242
Boulder Harbor
ECREATION AREA
Lagoons
Lake Mead Marina
Pyramid Island
Pump
INTAKE
LAKE MEAD
BM 1251
AQUEDUCT
Filtration Plant &
Tank
Sewage Lift Station
Lake Mead Lodge
Picnic Area
Sewage Lift Station
LAKESHORE ROAD
Boulder Beach
Outdoor Theater
Boulder Beach Campground
Gravel Pit
Sewage Lift Station
Trailer Park
Tanks
Gravel Pit
BM 1341
OLD RAILROAD GRADE
Wash
Hemenway Campground
Boat Ramp
Hemenway Harbor
Sewage Lift Station
Gravel Pit
Pumping Plant No 1
WT
So Nevada Water Line
BOULDER CITY LATERAL
BM 1447
RESTRICTED
Hemenway
Prospect
Septic System
Water Tank
Visitor Center
Hydropneumatic Tank
Gravel Pit
Gravel Pit
TO BOULDER CITY
Scale: 1"=2,030'

WATER SYSTEM

Raw water is obtained from Lake Mead at Pyramid Island. This island is located near the marina and is accessible by foot during low water levels. Boulder Beach is the largest consumer of water in the recreational area. In 1988, 164.3 million gallons of water were used within the Boulder Beach development. Annual average demand and peak monthly demand is 450,000 gpd (312 gpm) and 748,700 gpd (570 gpm) respectively. A summary of the 1988 water records are presented below:

TABLE 9
BOULDER BEACH - WATER USE

MONTH	WATER USE (MG)
JANUARY 1988	8.838
FEBRUARY 1988	7.450
MARCH 1988	11.427
APRIL 1988	11.263
MAY 1988	14.126
JUNE 1988	22.460
JULY 1988	16.944
AUGUST 1988	17.604
SEPTEMBER 1988	14.812
OCTOBER 1988	16.875
NOVEMBER 1988	13.198
DECEMBER 1988	9.291

Raw water quality is excellent. Influent turbidity ranges from 0.20 to 6.06 ntu; average turbidity is 0.88 ntu. Quarterly coliform tests from samples obtained at the intake pump were negative. Water samples obtained from the swim beach 1 1/2 miles away measured coliform counts from 10 to 1,100 organisms per 100 ml.

Water is pumped from the Lake Mead intake structure by three 1,050 gpm pumps located at Pyramid Island through a pipe under the marina causeway to the 1.5 MGD filtration plant. The water plant was constructed in 1968. Water is first settled in a 35-foot diameter tank that was originally used as a flocculator. Piping allows staff to bypass directly to the filters if necessary. Hydraulic detention time at average and design flows is 5.8 and 1.8 hours, respectively.

Four manually operated filters remove suspended solids through 30 inches of stratified sand, anthracite coal and gravel. A polymer solution is added to the clarifier upstream of the filters to enhance solids capture. Each filter is 10.5 feet in diameter, providing a surface area of 87 sq. ft. The design filter rate is 3.0 gpm/sf. Effluent turbidity averages 0.28 ntu. Chlorine solution is injected upstream of the 23,000 gallon clearwell and 250,000 storage tank, providing a chlorine contact time of 4.7 hours. Aboveground tanks are used to store 2.523 million gallons of treated water. A 0.25-million gallon, welded steel tank is adjacent to the water treatment plant. A welded steel tanks, with 2.0-million gallon and an underground concrete tank with 0.375-million gallon capacities are located just west of the campgrounds and trailer village. All three tanks supply the shoreline development by gravity.

Water is pumped from the 2.1 MG tank to a fourth storage tank located at the Visitor's Center. This tank has a capacity of 0.025 million gallons, located approximately 2 miles from the main Boulder Beach development. A hydropneumatic tank boosts pressure from the 0.025 MG storage tank to the Visitor Center. The hydropneumatic tank is capable of delivering 4,320 gallons of water per hour. Average and peak demands at the Visitor's Center are estimated at 2,000 and 5,600 gallons per hour respectively. Controls for the hydropneumatic system are antiquated and unreliable. Both the domestic and fire pumps have required considerable maintenance in the last few years. Continued use of the hydropnuematic tank to serve the Visitor's Center is not recommended since the peak water use exceeds the system's capabilities, and there are numerous equipment problems.

A nonpotable water system is used as supplement irrigation at the Hemenway campgrounds. The raw water is removed from Lake Mead by two 600 GPM pumps located on a floating barge approximately 50 feet offshore at the boat launch.

The entire Boulder Beach development will require storage of 1.0 million gallons of water to meet a 2-hour fire flow of 1500 gpm and a 24-hour annual future average domestic water supply. The available storage capacity exceeds this, so that additional storage will not be required.

Based on the water records, it is estimated that 13% of treated water is returned to the sewer system. The remaining 87% , or 164 million gallons, is mostly used for irrigation around the development. Annual cost of irrigation is estimated at $124,100.

WASTEWATER SYSTEM

A combination of gravity and pressure sewer lines collect wastewater from all Boulder Beach facilities except the Visitor Center. A majority of the 4- to 8-inch vitrified clay pipe is over 20 years old. Five pump stations are located throughout the collection system. Three stations are new suction lift type stations installed within the last 2 years by park staff. All are reported to be operating extremely well. Two of the suction lift stations operate in series to pump from Boulder Beach to the lagoons. This station has a capacity of 225 gpm. Peak sewage flow to the main lift station is presently estimated 167 gpm. Anticipated future peak flows of 192 gpm are within the present pump capabilities. The third suction lift station is located at Hemenway Beach. It has a capacity of 150 gpm and is adequate to handle future wastewater flow from Hemenway Beach estimated at 95 gpm.

The fourth station is a submersible lift station that has a capacity of 100 gpm. This serves the Boulder Beach campground. Future sewage flows from the campground area are projected to be 115 gpm. The lift station is antiquated and difficult to access. Also, the station is undersized for the future flow. The station should be replaced because of the current problems, and projected undersizing. A fifth station serves an isolated comfort station and handles the flows currently although antiquated, and has few documented maintenance problems.

Annual average wastewater flow for 1988 was 0.059 mgd; total wastewater treated in 1988 was 21.65 million gallons. The wastewater flows are summarized below.

TABLE 9
BOULDER BEACH - WASTEWATER FLOWS

MONTH	AVERAGE FLOW (MGD)
JANUARY 1988	0.045
FEBRUARY 1988	0.049
MARCH 1988	0.050
APRIL 1988	0.072
MAY 1988	0.063
JUNE 1988	0.063
JULY 1988	0.096
AUGUST 1988	0.063
SEPTEMBER 1988	0.061
OCTOBER 1988	0.060
NOVEMBER 1988	0.050
DECEMBER 1988	0.037

Biological treatment of the waste is accomplished in four stabilization lagoons constructed in 1984. The total surface area of the four lagoons is 6.4 acres. The two non-aerated primary lagoons have surface areas of 1.4 and 1.1 acres. Both are lined with asphalt an influent piping arrangement allows raw sewage to be piped to either or both lagoons. A 2.0-acre lagoon is used for settling and evaporation. The fourth 1.9-acre lagoon is used for evaporation and percolation.

Average detention time is 45 days. Influent BOD ranges from 70 mg/l to 350 mg/l based on grab samples tested during 1988. Average and peak monthly organic loads to the primary lagoons are 95 and 156 lbs. per acre per day. The Nevada Division of Environmental Protection allows a maximum loading of 50 pounds of BOD per day. Both average and peak organic loadings exceed the state's limit.

The park has installed conduit to power floating aerators. Upon installation of the aerators, the organic loading requirements will be under the maximum loading of 178 lbs. per BOD per day for aerated lagoons.

The Visitor Center uses on-site treatment and disposal. It is served by a 4,500 gallon septic tank and, although undersized for the 10,000 square foot, Visitor Center, is operating well. The system has not required significant preventive maintenance and also is noted to be operating quite satisfactorily.

Construction of a conventional gravity sewer to serve the Visitor Center was considered as part of this study. The waste would be directed to the Hemenway Beach lift station, approximately 1 mile east. Construction of the sewer to carry wastewater from the Visitor Center would cost an estimated $360,000. Construction of the sewer line is extremely costly and would have serious environmental impacts on the terrain. This option was dropped in favor of upgrading the existing septic tank to a large two-compartment unit with a new soil absorption field.

RECOMMENDED IMPROVEMENTS

WATER SYSTEM

Future annual average and peak month water demands are estimated at 517,000 gpd (360 gpm) and 861,000 gpd (598 gpm), respectively. This use can be met with the existing pumping capacity of 1,050 gpm and treatment capacity of 1.5 mgd.

Continued operation of the Boulder Beach Water Treatment Plant is a viable option for meeting future water needs if equipment upgrades are completed to ensure reliable operation. These improvements include replacement of the manual valves with automatic valves, replacement of the underdrains, and exterior painting of plant basins. Estimated construction cost for these improvements is $52,200. Annual operating and maintenance costs for the existing facility are estimated at $164,200.

Another option, to purchase water from another organization rather than providing treatment for the entire Boulder Beach development, has several advantages. No improvements would be required at the existing water treatment plant under this plan. The Southern Nevada Water District (SNWD) is the most logical choice for water procurement. This consortium of Nevada water users includes Boulder City, Las Vegas Wash, and Henderson, to name a few of its members. SNWD owns and operates a 200-MGD water treatment facility just north of Boulder Beach. The Southern Nevada-Boulder City lateral crosses NPS property near the 2.0 MG water tank. Connecting to the waterline near the large storage tank would be relatively inexpensive.

Estimated cost of the connection would be $125,000 based on construction of a pressure reducing connection designed several years ago by the US Bureau of Reclamation. An additional cost for membership to SNWD would be anticipated. Park staff has thrown out the fee of "a quarter of a million dollars" based on previous negotiations. This is probably a realistic fee based on the size of Lake Mead relative to the size of the other members and the outstanding debt of SNWD. Annual operation and maintenance cost for this option would be $377,400.

Continued use of the existing water plant has a lower present worth cost. It is recommended that the park continue operation of this facility.

The existing storage volume of 2.1 million gallons exceeds the projected storage requirements of 1.8 million gallons. The exterior surface of all tanks show no indication of rusting. No internal inspection has ever been conducted. It is recommended that the interior surface of all tanks be inspected to evaluate the interior wall condition. If necessary, surface restoration should should be done.

The existing capacity for water delivery to the Visitor Center through the hydropnuematic system is undersized for the water demand. Water demand often exceeds the existing capacity, resulting in low operating pressures. The hydropneumatic system could be modified to increase delivery by upgrading the pumps, replacing the controls with electronic controls, and installing a bladder to help maintain tank pressures. Estimated cost of the improvements is $30,000. Annual operation and maintenance costs for water delivery to the Visitor Center is estimated at $6,400.

Another option for water service to the Visitor Center is to purchase treated water directly from Boulder City. This would be feasible due to the proximity of city water located along U.S. 93. Estimated construction cost to connect to the city line would be $70,000. Annual operation and maintenance costs for purchasing water from Boulder City are estimated at $14,600.

In summary, the recommended water improvements at Boulder Beach total $220,000 and include:

- Connect the Visitor Center to Boulder City's Water system @ $70,000 (BBW1)
- Upgrade the water treatment plant @ $130,000 (BBW2)
- Interior inspection of all water storage tanks @ $20,000 (BBW3)

WASTEWATER SYSTEM:

Future annual average and peak month flows are estimated at 68,000 gpd and 110,000 gpd based on a 15% increase over the present flows. The future peak monthly organic loading is predicted to be 177 lbs. per BOD per acre per day. The area required for the future annual average flow of 0.068 mgd is 5.7 acres. The existing 6.4-acre facility has adequate surface area for treatment and disposal of the projected flows. It is assumed that the park will proceed with their plans to install surface aerators. These will provide sufficient oxygen to satisfy both current and future organic loads.

The campground lift station does not have adequate capacity for future flows and should be replaced with an aboveground lift station. Estimated cost for the station is $138,000

It is recommended that the park continue to use on site treatment and disposal. It is recommended that the septic tank and soil absorption field be replaced as part of cyclic maintenance. In addition, it is recommended that a dosing tank be installed upstream of the new soil absorption field. Estimated construction cost of the work is $120,000

In summary, the estimated cost for Boulder Beach wastewater improvements total $258,000 and include the following:

- o Replace campground lift station @ $138,000 (BBWW1)
- o Replace Visitor Center Soil absorption field and install a dosing tank @ $120,000 (BBWW2)

LAS VEGAS WASH

SITE DESCRIPTION

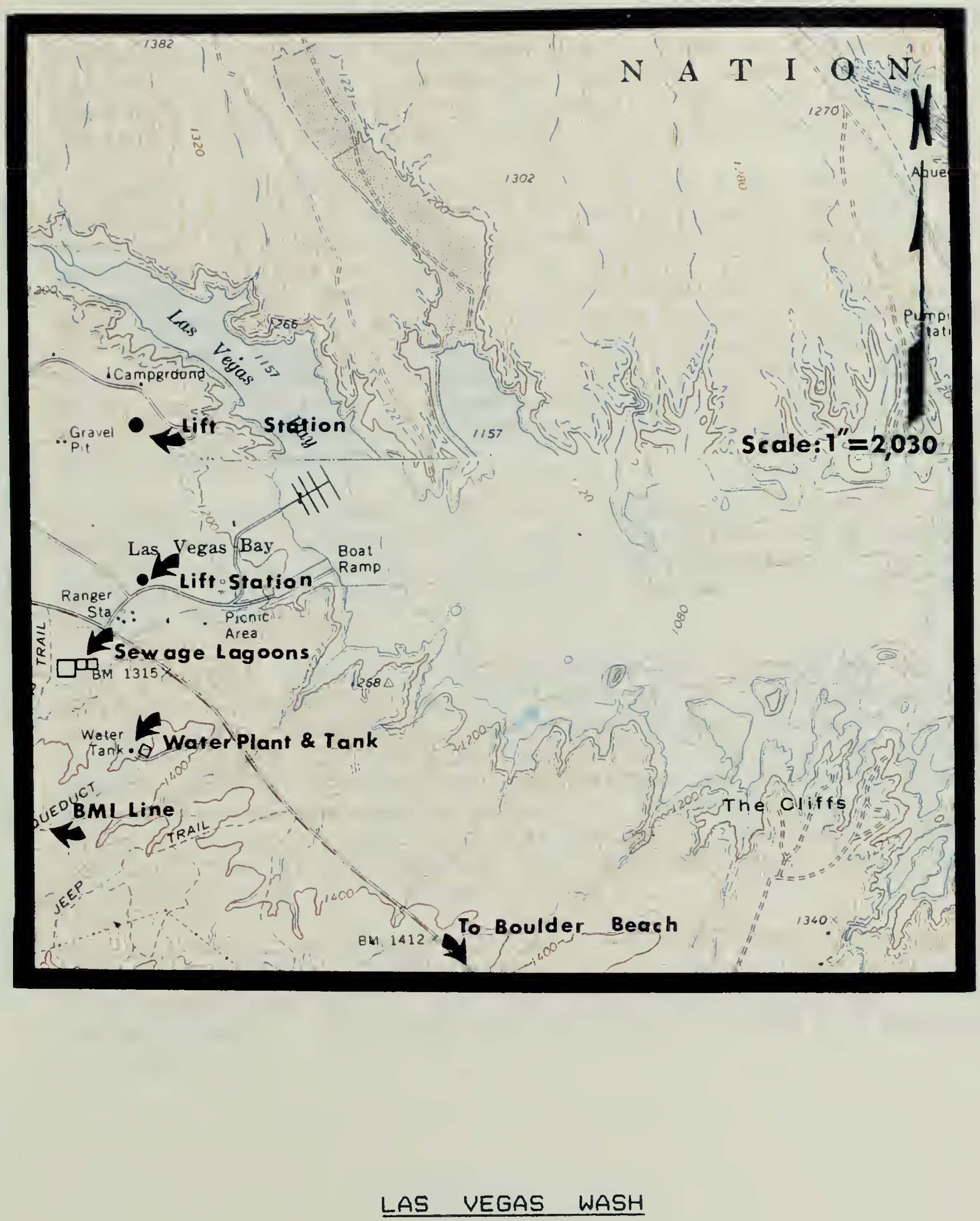
This marina is located 7 miles north of Boulder Beach at the confluence of Las Vegas Wash and Lake Mead. Access to the area is from Lakeshore Road. The development is popular for day use because of its close proximity to the Las Vegas metropolitan area. Records indicate that the annual average number of visitors is 120 per day. The area is very popular during the summer with water skiers, hot-boaters, and fisherman.

The marina contains 645 slips. The General Management Plan would allow expansion; however, the concessioner has no future plans to do so. Visitor services are limited at Las Vegas Wash. The concessioner operates a 36-seat floating restaurant and store at the marina.

The only overnight visitor facility is the 89-site campground operated by the park. The park also maintains four residences at Las Vegas Wash for NPS personnel. Plans to construct a 80-site trailer village in the next few years have been proposed by the concessioner. Flow figures for the development reflect an increase due to the proposed facility.

The existing utilities are overused and operating at their limits. It is anticipated that the area will continue to see an increase of 15% per annum due to the rapid growth of the Las Vegas metropolitan area. A new development, Lake of Las Vegas, is under construction just outside the park's west boundary, within 300 feet of Northshore Drive. The development is proposed to contain several casinos, golf courses, hotels, and multi-residential property. The proximity of this development will significantly impact Las Vegas Wash.

Las Vegas Wash is served with single-phase power. The park staff has indicated that three-phase may be installed at the development when the trailer village is constructed.



LAS VEGAS WASH
SITE PLAN

WATER SYSTEM

Raw water for Las Vegas Wash is obtained from Lake Mead just north of Boulder Beach. The intake and water line constructed to serve the industrial complex in Henderson is owned and maintained by Basic Management Inc. (BMI). Raw water is transported through a 40-inch diameter pipe line located under Lakeshore Drive. The pipe line alignment is west across park property at the Las Vegas Wash Water Plant to a connection to the water plant. A pressure reducing vault reduces line pressure from 320 psi to 60 psi. The Park Service has obtained water from Basic Metals Inc. pipeline since 1940.

Influent turbidity ranges from 0.16 to 5.06 ntu's; average influent turbidity is 0.83. No sedimentation facilities are provided. The water is processed directly through two Walker pressure filters (installed in 1984). Each filter has a capacity of 60 gpm, for a total capacity of 120 gpm. A polymer solution is added to the water upstream of the filters to enhance solids capture. The pressure filters are automatically backwashed based on a set headloss across the dual media filters. Pressure filters are likely to have particulate breakthrough, although this has not been a problem at Las Vegas Wash.

Although the present effluent turbidity is 0.35 ntu's, addition of a flocculation basin upstream of the pressure filters would improve treatment capabilities by increasing particle size which will improve overall particle removal through the filters.

The treated water is disinfected by injecting chlorine solution upstream of the 100,000 gallon aboveground steel water tank. Presently, the chlorine gas is mixed with raw water to make the chlorine solution. This is a potential health hazard. Organisms unaffected by chlorine could be injected into the treated water. It should be repiped so that treated water is used for the chlorine solution. Chlorine contact time is provided by the water storage tank. Typical detention time is 18 hours.

The Las Vegas Wash area used 26.5 million gallons of water in 1988. Current annual average and peak monthly demands for the system are 79,000 gpd (55 gpm) and 128,400 gpd (89 gpm) respectively. The water use records for 1988 are summarized in Table 10.

TABLE 10
LAS VEGAS WASH - WATER USE

MONTH	WATER USE (MG)
January 1988	6.693
February 1988	0.983
March 1988	1.537
April 1988	N.A.
May 1988	2.703
June 1988	3.212
July 1988	3.980
August 1988	3.117
September 1988	3.109
October 1988	3.872
November 1988	1.757
December 1988	1.580

Minimum storage requirements for a 2-hour, 1,000 gpm fire flow is 120,000 gpd. Future 24-hour domestic demand for Las Vegas Wash is predicted to be 90,000 gpd. Total water storage volume required at Las Vegas Wash is estimated to be 210,000 gpd. Current water storage volume available is 100,000 gallons. An additional 110,000 gallons of storage volume is needed to supplement the existing tank. This shortage is evident even today. Staff notes that it is difficult to maintain minimum storage volume during peak visitation. Enforced water conservation in both park and concessioner activities may provide an interim solution to prevent low fire storage during periods of peak use. Park management will support this measure on an interim basis until additional storage supplies are available.

A considerable amount of water is used for irrigation at this development. Like other areas within the recreation area, Las Vegas Wash uses a ditch-type irrigation system. Only 9% of the treated water is returned to the sewage lagoons based on annual water and wastewater records. The remaining 91%, or 24 million gallons is annually used for irrigation. Annual cost for irrigation for Las Vegas Wash is estimated at $91,200.

WASTEWATER SYSTEM

The system is served with a gravity collection system composed of 4-inch to 8-inch diameter cast iron and vitrified clay pipe. Three pumping stations lift sewage up and out of the development.

The campground area is pumped to the main lift station by a 40-gpm pneumatic ejector. The station operates by pressurizing a compartment filled with wastewater and "ejecting" it into a pipe line. An air compressor is used to pressurize the tank. Frequent maintenance is required on the air compressors. Rewiring by park staff has improved reliability. It is recommended that the station eventually be replaced with an aboveground suction lift type station when three-phase power is provided at Las Vegas Wash. This recommendation is based on the poor maintenance record of phase convertors, presently used to convert single-phase power to three-phase power, at Las Vegas Wash.

The second lift station is a submersible lift station. Two centrifugal pumps, each with a rated capacity of 60 gpm, lift wastewater from the marina, restaurant, and picnic area to the main pumping station.

The main pumping station has an actual capacity of 55 gpm as measured by park staff. Future peak flows to the station are estimated at 45 gpm. Both pumps and motors have poor maintenance records. The station operated with only one pump for most of 1989. Replacement of the station with an aboveground station to ensure reliability is recommended.

Biological treatment is provided in a 0.95-acre stabilization facility. The facility consists of two lined lagoons with surface areas of 0.64 and 0.33 acre each. Current average flow is 5,500 gpd;peak monthly flow is 8,500 gpd.

Staff monitors biochemical oxygen demand and suspended solids levels. Raw wastewater grab samples indicate that the influent biochemical oxygen demand ranges between 95 to 334 mg/l. Current average and peak monthly organic loads are 8 and 51 pounds per acre per day, respectively. Increased lagoon area will reduce the organic loads below the maximum loading of 50 lbs. BOD/acre/day.

The Las Vegas Wash development generates an average monthly wastewater flow of 5,450 gpd. Monthly flows have been monitored since August 1988. Total wastewater treated in 1988 was 2.394 million gallons.

TABLE 11
LAS VEGAS WASH WASTEWATER FLOWS

MONTH	AVERAGE FLOW (MGD)
JANUARY 1989	0.003
FEBRUARY 1989	0.003
MARCH 1989	0.004
APRIL 1989	0.004
MAY 1989	0.010
JUNE 1989	0.006
JULY 1989	0.014
AUGUST 1989	0.008
SEPTEMBER 1989	0.010
OCTOBER 1989	0.008
NOVEMBER 1989	0.006
DECEMBER 1989	0.003

Nevada's Division of Environmental Protection (NDEP) issued the park a warning about the condition of the existing facility in July 1988. NDEP is concerned that the liner has deteriorated creating a potential for groundwater contamination by raw wastewater.

The facility will be expanded to 3.4 acres in late 1990. The design is being completed by the Denver Service Center under a separate project, Package LAME 353. The new facility will be designed for an annual average daily flow of 16,300 gpd. The increased capacity will accommodate wastewater from the proposed trailer village and increased visitation.

RECOMMENDED IMPROVEMENTS:

WATER SYSTEM

It is recommended that the park continue obtaining raw water from the BMI line. Surface water from Lake Mead closer to Las Vegas Wash may be a problem due to influence of the wash outlet. Another potential source is from the Henderson water system at Lake of Las Vegas. It is estimated that connection of a water line to transport portable water from Lake of Las Vegas to the Las Vegas Wash development would cost approximately $1,000,000.

Future average and peak monthly water demand is estimated at 90,100 gpd (63 gpm) and 147,700 gpd (102 gpm), respectively. The existing 120-gpm pressure filtration facility may have difficulty consistently meeting the turbidity MCL's required under the 1986 SDWA Amendments. Higher filter rates without pretreatment have a high incidence of solids breakthrough. It is recommended that a new 15,000 gallon flocculation basin be added upstream of the pressure filters to increase particle size to ensure treatment capabilities and operational reliability.

The development has inadequate water storage volume to meet the projected need of 237,000 gpd. It is recommended that a 110,000-gallon aboveground water storage tank be installed adjacent to the existing water plant and tank. Estimated construction cost of the water tank is $170,000.

It is also recommended that the existing tank interior be inspected to evaluate the surface condition. Estimated cost of the inspection is $5,000.

The park should use treated water to prepare the chlorine solution used for disinfection. Piping modifications to complete this are estimated at $8,000. In summary, the recommended improvements total $213,000 and include the following:

- Piping modifications to use treated water for chlorine solution make up water @ $8,000 (LVW1)
- Construct a 15,000-gallon flocculation basin @ $30,000 (LVW2)
- Construct a 110,000-gallon water tank @ $170,000 (LVW3)
- Inspection of the existing tank interior @ $5,000 (LVW2)

WASTEWATER SYSTEM

The lagoon capacity will be expanded from a total of 3.4 acres. Construction drawings for the modification have been completed and advertisement for construction should be underway. Estimated construction cost for this project is $440,000.

It is recommended that the main lift station be replaced with an aboveground suction lift style sewage station for an estimated cost of $138,000. The pneumatic type lift station would remain in service until the development has three-phase power.

As discussed in the overview, the only portable power sources are at Boulder Beach and Katherine. It is recommended that the existing generator remain at Boulder Beach and that another unit be purchased for Las Vegas Wash. This is particularly critical when the lift station is located near the shoreline, and a potential health hazard due to sewage overflows exists. A 30 KW gasoline-powered enclosed trailer-mounted generator would be sufficient to operate the lift stations in the event of a power failure. Estimated cost for the unit is $25,000.

In summary, the total cost for wastewater improvements is $603,000 and includes:

- Expansion of the sewage lagoon capacity @ $440,000 (LVWW1)
- Replacement of the sewage lift station @ $138,000 (LVWW2)
- Purchase portable generator @ $25,000 (LVWW3)

CALLVILLE BAY

SITE DESCRIPTION

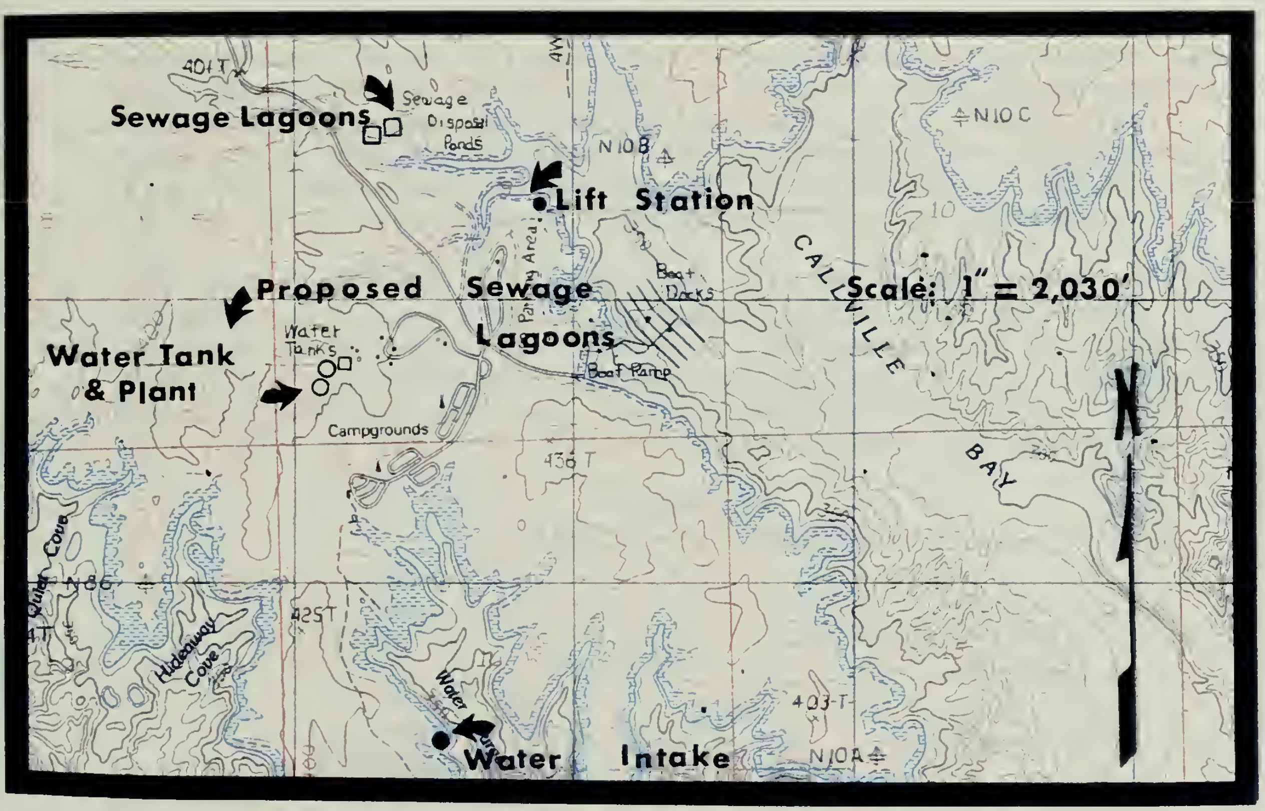
Callville Bay is an located 27 miles north of Boulder Beach and 28 miles east of Las Vegas. Lake Mead landforms provide a natural harbor at Callville Bay that attracts visitor to the development for boating and fishing. Visitation at Callville Bay was estimated at 178 visitors per day.

Slips for 300 boats are available. The General Management Plan will allow expansion of the marina to 1,045 slips. The charter boat service is restricted, currently providing 15 houseboats and 33 other boat rentals. The concessioner has discussed the possibility of expanding the houseboat rental business.

Development at Callville Bay has been restricted due to the steep topography. Overnight and visitor services are limited. Overnight camping facilities at the 80-site campground are maintained by the Park Service. A concessioner-operated trailer village provides 94 long term sites and 6 short term sites. Construction of Phase 1 of an 100-unit motel was planned for 1990. This has been delayed.

A new store and lounge facility was constructed in 1986 and the old lounge converted to a full service restaurant.

Eight trailers are provided for staff housing at Callville Bay.



CALLVILLE BAY
SITE PLAN

WATER SYSTEM

Raw water is obtained from Lake Mead, from an intake located southeast of the treatment plant. Raw water intake pumps on the floating barge lift water to the treatment facility. The barge floats and deck have rusted and the pipe line floats have deteriorated. The entire barge should be replaced to ensure reliable operation. The floating barge supports two end suction centrifugal intake pumps. Each pump has a rated capacity of 300 gpm. Minimal maintenance has been performed on the pumps since they were installed 20 years ago.

Influent turbidity averaged 0.55 ntu's in 1988. The coliform count was less than 10 organisms per 100 ml for the quarterly samples taken in 1988.

Raw water is pumped from Lake Mead to a 0.3 million gallon aboveground steel storage tank located near the water plant. Raw water can be fed by gravity to the water treatment plant or used directly for irrigation and fire protection. The irrigation and fire system water is distributed throughout the area by a separate nonpotable water pipeline. Callville Bay is the only development with separate water systems.

Raw water pumped at Callville Bay for 1988 totalled 79.43 million gallons. Domestic water usage was estimated at 38 percent based on water records. The remaining 62 percent of raw water was used for either irrigation or fire protection. Monthly average and peak use of potable water was 78,800 gpd (55 gpm) and 125,000 (87 gpm) gallons per day respectively.

TABLE 12
CALLVILLE BAY WATER USE

MONTH	WATER USE (MG)
JANUARY 1988	1.625
FEBRUARY 1988	1.468
MARCH 1988	2.037
APRIL 1988	1.987
MAY 1988	2.596
JUNE 1988	3.171
JULY 1988	3.880
AUGUST 1988	2.996
SEPTEMBER 1988	3.338
OCTOBER 1988	2.867
NOVEMBER 1988	2.470
DECEMBER 1988	1.942

Raw water is processed through a 200-gpm water treatment plant installed in 1968. The water is first settled in an 18-foot 6-inch diameter basin, originally operated as a flocculator. Detention time for average and design flows are 9 and 2.5 hours, respectively. Polymer is added prior to the 11-foot 6-inch diameter mixed media gravity sand filters. Average filter rate is 2 gpm/sq. ft. Treated water turbidity averaged 0.14 ntu's in 1988. Chlorine solution used for disinfection is injected upstream of a 32,000-gallon clearwell. A chlorine contact time of 2.6 hours is provided.

Treated water is stored in a 100,000-gallon steel tank before distribution throughout the development. Residual chlorine concentrations are maintained throughout the system.

Emergency power is provided at both the raw water pump station and water treatment plant.

Three hundred thousand gallons of raw water is available for fire protection. Fire storage based on a 2 hour fire flow of 1000 gpm requires 120,000 gallons of storage. Present storage capacity exceeds this requirement.

Future domestic water storage required at Callville Bay is estimated at 90,000 gallons for a 24-hour storage of the average water demand. Theoretically, the existing tank volume should be adequate for the domestic demand; however, park staff has documented problems with maintaining tank levels during peak use periods.

Several options are available to meet the water demand using existing storage facilities.

One option would be to switch the dedicated use of the two tanks. Pipe modifications to convert the 300,000-gallon tank to a potable storage tank and the 100,000-gallon tank to a raw water tank would cost an estimated $30,000. The end result would be a 300,000-gallon storage tank for treated water. The 100,000-gallon tank would serve the fire protection system and the nonpotable water system.

The problem with this option is that it does not provide adequate fire storage volume. Reconnection of the fire system to the portable system would alleviate this problem. This additional construction cost is estimated at $25,000. Total cost of this option would be $55,000.

A less costly alternative would be a cross connection between the two tanks for activation only in the event of fire. This would allow treated water to supplement the nonpotable fire system. This action is not recommened since it is not as dependable as other options and has an inherent health risk associated with it.

The other option would be to convert the raw tank to a treated water tank. The estimated construction cost for piping modifications and tank upgrades was estimated at $20,000. This option would eliminate the dual water systems presently in place at Callville Bay. This option does not promote water conservation and is not recommended although the construction cost is lower than reversing the tank use.

A final option would be to construct additional treated water storage. The construction cost for additional 80,000-gallon water storage would cost an estimated $160,000. This additional volume was based on the future peak month average daily water use rather than the average daily water use since records indicate that this is a more accurate reflection of water demand at Callville Bay.

WASTEWATER SYSTEM

The sewage collection system consists of small diameter ductile iron gravity and pressure pipe. A pneumatic ejector station pumps sewage from the campground into the main gravity system. This station has a capacity of 40 gpm. According to park staff, the station often runs continuously during peak use. This has necessitated considerable compressor maintenance. It is recommended that the pneumatic ejector be replaced with an aboveground suction lift type station.

Sewage from the entire development flows to the main lift station located at the edge of Lake Mead, north of the marina. The underground station contains two centrifugal pumps, each rated at 300 gpm. The access hatch is located below the high water level and, at times, has been flooded. The corrugated pipe sections enclosing the opening to the station and wet well are not watertight. The access tube should be raised to provide safe, watertight protection to the facilities. Wastewater flows are measured at the station, based on pump run time. A total of 6.98 million gallons of wastewater was treated in 1988. Daily sewage flows are estimated at 24,000 gpd.

TABLE 13
CALLVILLE BAY WASTEWATER FLOWS

MONTH	AVERAGE FLOW (MGD)
MARCH 1988	0.022
APRIL 1988	0.021
MAY 1988	0.026
JUNE 1988	0.027
JULY 1988	0.030
AUGUST 1988	0.021
SEPTEMBER 1988	0.022
OCTOBER 1988	0.019
NOVEMBER 1988	0.016
DECEMBER 1988	0.024

Wastewater is pumped from the main lift station to two stabilization lagoons, each with a surface area of 0.85 acres. One lagoon is lined with bentonite;the other is unlined. Staff normally operates the lined lagoon, using the unlined lagoon for overflow during periods of high flows. Influent BOD concentrations range from 75 to 308 mg/l. Average and peak month organic loadings are estimated at 44 and 96 lbs. per acre per day.

RECOMMENDED IMPROVEMENTS:

WATER SYSTEM

Future monthly average and peak water use is estimated at 63 and 100 gpm respectively. The existing intake pumps and treatment facility are sized to handle the anticipated flow. It is recommended that the pumps and motors be rehabilitated as part of cyclic maintenance to ensure reliability. The floating barge and pipe floats have deteriorated. The construction cost for this work is estimated at $85,000.

It is also recommended that a new 80,000-gallon tank be constructed to provide domestic water storage. Estimated cost of a new tank would be $160,000.

Total cost of water system improvements at Callville Bay is $255,000 and includes:

- Construct 80,000 gallon water storage tank @ $160,000 (CBW1)
- Replacement of the intake barge @ $ 85,000 (CBW2)
- Inspect the internal surface of the existing two tanks @ $10,000 (CBW3)

WASTEWATER SYSTEM

Future annual and peak monthly flows are estimated at 0.037 and 0.042 mgd, respectively. The State of Nevada, Division of Environmental Protection, warned the park that the facility is not in compliance. Specific defects noted included high organic loads, no perimeter fence, inaccessible site during high water, and deteriorated slope conditions.

A preliminary design as part of Package LAME 353 is currently underway with construction anticipated in FY 91. Sewage treatment and disposal will continue to use stabilization lagoons and evaporation. The lagoons will be relocated south of the present site to an area near the existing water plant. The proposed facility will provide approximately 2.7 acres of lagoons. Two of the lagoons will have surface aeration equipment installed to enhance biological activity.

The main pump station will be replaced with a new station. The new pumps will operate at a higher head in order to lift sewage to the new lagoon site. The new lift station will be constructed above the high water level. This will eliminate the potential of flooding at high water levels.
A new force main will be installed to transport the sewage to the new facility. Both the lagoons and access road will be above the high water level.

The nearest portable generator is located at Boulder Beach. Round trip travel time to obtain a portable generator for Callville Bay can exceed an hour. Due to the proximity of the lift station it is possible that a sewage overflow could contaminate a section of Lake Mead during an extended power outage. It is recommended that a portable generator be located at the development to reduce the risk of sewage overflows. It is recommended that a trailer-mounted, gasoline-powered, enclosed generator be provided to operate both lift stations in the event of an extended power outage. Estimated cost of the 30 KW generator has been included with the total project cost.

The new wastewater treatment facility will be constructed for an peak month flow of 42,000 gpd. The estimated construction cost for the new lagoons, lift station, and force main is $2,200,000.

It is recommended that the park replace the campground station with an aboveground type suction lift station. Estimated construction cost for the lift station replacement is $138,000.

In summary, the total estimated construction cost for improvements to the Callville Bay wastewater system is $2,338,000 and includes:

- Construction of 2.7 acres lagoon site, relocation of force main relocation, and replacement of the main lift station @ $2,200,000 (CBWW1)

- Replacement of the campground lift station @ $138,000 (CBWW2)

ECHO BAY

SITE DESCRIPTION

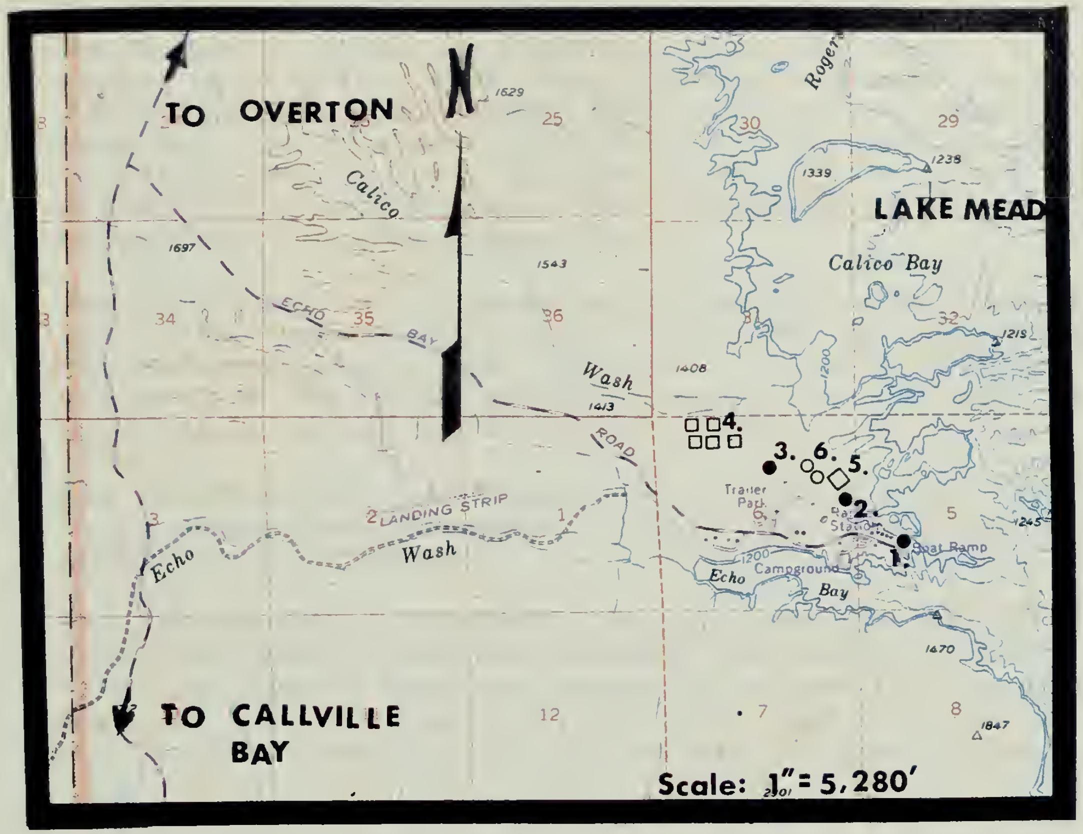
Echo Bay is located on the Overton arm of Lake Mead, 47 miles north of Boulder Beach. Situated on a high bluff, Echo Bay provides spectacular lake views. The distance from the major metropolitan areas contributes to the relatively uncrowded conditions. Visitation is estimated at 137 people per day.

The development provides both overnight and day-use accommodations. A 166-site campground is available for tent camping. The park has plans to convert half of these sites to a short term RV park.

The concessioner operates a 127-unit trailer village, with 69 sites designated for long term use. A 52-unit motel, located on Lake Mead, is popular with overnight visitors.

The marina provides 314 slips. The General Management Plan will allow expansion of the marina to 530 slips. The concessioner charters 88 houseboats to visitors and has discussed the possibility of expanding this service. Waste from the marina is pumped to the sewage collection system.

Seven residences are provided for park staff; 34 units are designated for concessioner employees in the trailer village.



KEY

Lower Lift Station	1
Middle Lift Station	2
Upper Lift Station	3
Sewage Lagoons	4
Water Plant	5
Water Tanks and Hydropneumatic Station	6

ECHO BAY

SITE PLAN

WATER SYSTEM

Raw water is obtained directly form Lake Mead. A floating barge located in Lake Mead houses the end suction type centrifugal raw water pumps that are over 20 years old. Each pump has a rated capacity of 225 GPM. The park staff recently verified that actual pumping rate is 150 gpm. Minimal preventive maintenance has been completed on the pumps. The barge floats and deck have rusted.

The pipeline floats have deteriorated and several are missing. The barge has recently been relocated to deeper water to reduce turbidity of the raw water. The barge will be more susceptible to winds and wave action at the new location, which may accelerate its deterioration.

Raw water turbidity averaged 0.54 ntu in 1988. Seasonally high values have exceeded 1 ntu's when the lake level has significantly changed.

The 225 gpm water treatment facility was constructed in 1967. Park staff estimates that current capacity is around 145 gpm. Water is pumped from the barge to a 20-foot diameter basin that was once used as a flocculator. Detention times of 4.6 and 2.1 hours are typical of average and peak flows.

The average and peak overflow rates are 36,700 and 63,000 gpd/lf, respectively. The 2.5 foot weir is submerged at peak pumping rates.

Filtration is accomplished by a single automatic valveless gravity filter, designed for a flow of 340 gpm. Average effluent turbidity from the filter was 0.24 in 1988. The filter unit has been increasingly difficult to operate.

The unit has had several breakthrough problems. The limited backwash capabilities were a significant problem during a period of high influent turbidity last year, and the unit experienced a significant loss of filter media.

Since no backwash waste pond is available, the backwash waste drains to an adjacent wash, creating an artificial environment for vegetation. A backwash waste pond must be constructed to contain the waste rather than continuing the discharge.

A chlorine solution composed of chlorine gas mixed with treated water is used to disinfect the filtered water. The chlorine solution is injected upstream of the 21,000-gallon clearwell. Chlorine contact time of 2 hours is provided.

Two 200-gpm pumps are located in a building adjacent to the filter. These pumps lift treated water to two aboveground welded steel tanks. Storage capacity of 100,000 and 500,000 gallons per tank is provided. This volume of water storage is more than adequate to meet the storage requirements based on a 2-hour fire flow of 1,000 gpm and the 24-hour average daily demand.

Water to the lower campgrounds, staff housing, motel, and restaurant is distributed through a gravity water system from either tank. Operating pressure is normally 50-60 psi.

The 127-unit trailer village and upper campground is served with a hydropnuematic pressurized system. The hydropnuematic tank feed pumps are located in a building adjacent to the water storage tanks and hydropnuematic tank. Water is fed to the hydropneumatic tank from either tank.

A problem with the hydropnuematic system is that the upper campground and trailer village often experience low pressures and erratic delivery. Typical use of a hydropnuematic tank is for a small system, usually serving less than 25 homes. Frequent cycling substantially reduces the system pressures when used to serve a larger system.

The park attempted to increase the operating pressures by installing larger pumps, which now must be throttled to prevent overfilling the tank. The system should be removed and replaced with a water tank located uphill from the trailer village.

Building deficiencies were noted at both the lower pump station, located at the water plant, and the upper pump station, located at the storage tanks. The lower pump station has cracking of the mortar joints between the concrete masonry units on the north wall. Also, the roof leaks. The wall and roof should be repaired to prevent further damage to the structure and the equipment housed in the building.

The pump station located at the storage tanks has similar wall cracks along two walls. Rehabilitation and remodeling to accommodate pumps for the new tank are recommended. Total water pumped in 1988 at Echo Bay was 53.81 million gallons. Monthly average and peak month demand was 147,400 gpd (102 gpm) and 255,000 gpd (176 gpm), respectively. The monthly water usage is summarized below:

TABLE 14
WATER USE ECHO BAY

MONTH	WATER USE (MG)
JANUARY 1988	2.511
FEBRUARY 1988	2.824
MARCH 1988	3.535
APRIL 1988	3.713
MAY 1988	5.339
JUNE 1988	6.828
JULY 1988	7.899
AUGUST 1988	6.394
SEPTEMBER 1988	5.134
OCTOBER 1988	4.148
NOVEMBER 1988	3.113
DECEMBER 1988	2.358

WASTEWATER SYSTEM

Sewage from the Echo Bay development flows by gravity to three lift stations. All three lift stations are packaged, wet well, dry pit type stations.

Wastewater from the concessioner facilities, staff housing, and the lower campground flows to the lift station located at the edge of Lake Mead, near the motel. The firm pumping capacity of the station is 100 gpm. Park staff recently verified that the actual pumping rate is 90 gpm. The station frequently runs continuously during periods of high visitation. The station is undersized to handle the present peak flow, estimated at 128 gpm. Design should be for the anticipated peak flows of 150 gpm. The undersized station is a serious problem due to its proximity to Lake Mead.

Sewage overflows are a potential problem due to the insufficient capacity of the pumps. An overflow would create serious health risks and a public relations problem for the Park. The pump station should be replaced with a larger capacity station. It is also recommended that a portable generator be purchased for the Echo Bay development to minimize the risk of a sewage overflow.

Sewage is pumped to an intermediate station rated at 100 gpm, located near the water treatment plant. Ths is undersized to handle the present peak flow estimated at 125 gpm. It also should be replaced with a larger, aboveground suction lift type station. The final station is located near the trailer village. The wet well collects sewage from both the upper campground and trailer village and the lower two pump stations. The pumps are rated at 145 gpm. Again, the capacity is again undersized for the estimated present peak flow of 150 gpm.

Biological treatment of the sewage is completed in three stabilization lagoons. Two lagoons are aerated with surface aerators. Both are lined with synthetic membrane material. The lagoons have surface areas of 0.5 and 1.2 acres. A third non-aerated membrane lined lagoon has a surface area of 1.6 acres. The facility is piped so that raw sewage can be applied to either of the two aerated lagoons.

Two additional lagoons are located outside the fenced portion of the facility. Each has a surface area of 1.2 acres. Neither lagoon has ever been operated by the park.

The present average and peak monthly flows are 25,000 gpd and 39,000 gpd. The lagoon influent BOD concentration ranged between 150-770 mg/l BOD. Average and peak month organic loadings are 80 and 193 lbs. of BOD per acre per day.

TABLE 15

ECHO BAY WASTEWATER FLOWS

MONTH	AVERAGE FLOW (MGD)
AUGUST 1988	0.039
SEPTEMBER 1988	0.034
OCTOBER 1988	0.014
NOVEMBER 1988	0.016
DECEMBER 1988	0.036
JANUARY 1989	0.018
FEBRUARY 1989	0.018
MARCH 1989	0.020
APRIL 1989	0.025
MAY 1989	0.034
JUNE 1989	0.034

An annual average flow of 41,000 gpd is projected for 2010. This flow will require 4.0 acres for biological treatment and evaporative disposal. Adequate lagoon surface area is available at Echo Bay; the existing facility provides a total of 6.5 acres. The 1.2-acre pond should be designated as the primary lagoon. The future organic loading would exceed the NDEP limits when using the 0.5-acre lagoon. The organic load is estimated at 91 lbs. per day. Minimum detention time at peak month flow is anticipated at 38 days.

RECOMMENDED IMPROVEMENTS:

WATER SYSTEM

Estimated future storage requirements for the development are 169,500 gallons for domestic use and 120,000 gpd for fire protection. No additional storage will be required;there is a total of 600,000 gallons currently available on site. The water intake barge should be replaced and relocated to the cove north of its present location . Deterioration of the barge from wave and wind action creates a risk to the system's overall reliability. The pumps should be rehabilitated or replaced. Replacement costs are estimated at $57,000.

The clarifier effluent weir should be enlarged to reduce the overflow rates Estimated cost for the repairs are $3,000. The existing filter should be replaced with a packaged dual media filtration unit. Erratic operational problems observed during recent years will become more critical with the turbidity requirements under the 1986 SDWA amendments and the need for consistent, reliable operation to meet turbidity maximum contaminant level. Wall and roof repairs at the lower pumping station are required to prevent further cracking and eliminate roof leaks that may cause equipment damage. A backwash pond should be constructed to ensure proper containment of the filter backwash waste. Estimated construction cost for all plant-related improvements is $1,900,000.

It is recommended that a new 150,000-gallon water tank be constructed to serve the trailer village and upper campground. This would replace the hydropneumatic system. The hydropnuematic system is antiquated, undersized, and inappropriate for use to feed the large permanent population of the trailer village. Although additional storage volume is not required, a tank would provide more reliable water service to the trailer village. Construction cost of new water lines and a water tank, as well as modifications for the pump station, is estimated at $425,000.

In summary, the total construction costs of the Echo Bay water system improvements are estimated at $2,410,000 and include:

- Replacement of the intake barge @ $85,000 (EBW1)
- Installation of a new filter, repairs to the existing filter building, and construction of a backwash waste pond @ $1,900,000 (EBW2)
- Construction of a new water tank and water lines @ $425,000 (EBW3)

WASTEWATER SYSTEM

All three sewage lift stations are undersized for the present flows operating continuously during weekends. The pumping capacity should be increased to provide a normal on/off sequence for the pump motors. It is recommended that the park replace all three lift stations. Construction cost is estimated at $138,000 each, or a total of $414,000.

A trailer-mounted gasoline-driven enclosed 30 KW generator is needed to provide a power source to the lift stations during outages. This is particularly critical with the lower lift station due to its proximity to the lake. One portable generator would be sequentially used to operate all three stations. Estimated cost of the generator is $25,000. In summary, total cost of the wastewater improvements recommended for Echo Bay is $439,000 and includes:

- Replacement of three sewage lift stations @ $414,000 (EBWW1)

- Purchase of a 30 KW emergency generator @ $25,000 EBWW2)

OVERTON BEACH

SITE DESCRIPTION

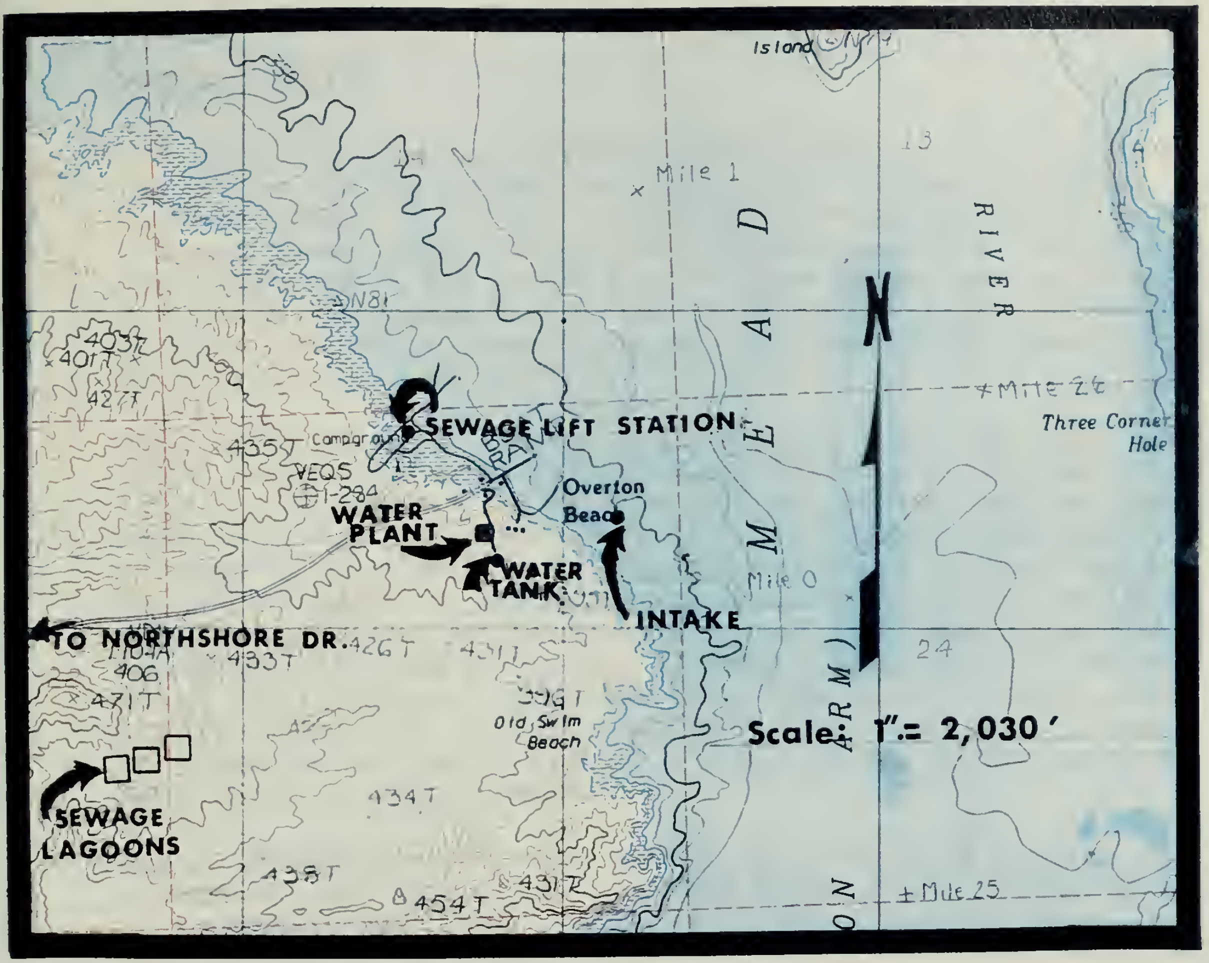
This development is one of the most remote and least crowded on Lake Mead. Overton Beach, located near the mouth of the Virgin River, is about 12 miles south of the town of Overton. Typical use of the Overton Beach area during the fall, winter, and spring is by fisherman. Pleasure boaters are the major visitors to the development during the summer. Park records indicate a daily average of 94 visitors to the area.

Major improvements to existing facilities have been completed by the NPS. Most utilities were relocated, replaced, or modified in 1983. Building and site modifications were completed in 1987. Improvements included replacement of all water, sewer and electrical utilities, relocation of the 32-unit trailer village, construction of a 100-site campground, construction of new sewage lagoon, construction of a new water filtration plant, and construction of a concessioner operated store.

Boat storage facilities are limited at Overton Beach. No marina is provided; fifty offshore moorings are provided along the immediate the shoreline.

The NPS recently installed two housing units for staff.

The development is served with single-phase power. This requires conversion to three-phase throughout the area, resulting in high maintenance with the rotophase converters. Three-phase power should be extended to the development in the future.



OVERTON BEACH

SITE PLAN

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WATER SYSTEM

Raw water is obtained from Lake Mead for Overton Beach. The raw water intake pumps are located on a submerge barge 1,500 feet offshore. The two submersible pumps are each rated at 100 gpm pump water. Staff has noted excessive vibration upon pump start-up. The pumps should be removed and overhauled to determine the source of the vibration. Preventive maintenance should be completed on the pumps while the system is temporarily out of service.

Water quality data indicates seasonally high turbidity levels. Staff can accommodate this through changes to the polymer dose rate. The turbidity levels may be influenced by nutrient additions by the Nevada Division of Fish and Wildlife to enhance fish growth in the Overton branch of Lake Mead.
The packaged water treatment plant was installed in 1983. It was designed for an average flow of 150 gpm. Raw water is pumped to two 2,500-gallon flocculation tanks. Polymer is added to enhance particulate removal. Particles are precipitated in a 3,500-gallon tube settler. The unit provides detention times of 6 and 1.7 hours for average and peak flows, respectively.

Two 37.5-square-foot dual media filtration units are used to screen out particulates. Average flows are filtered at a rate of 2 gpm/sf. Effluent turbidity averages 0.28 ntu's. Chlorine solution is used for disinfection. The solution is injected upstream of the 10,000-gallon clear well for a contact time of 2.5 hours at design flows.

Treated water is then pumped to a 300,000-gallon aboveground steel storage tank. Domestic storage for a 24-hour average flow requires 20,000 gallons of volume. Fire storage for a 2-hour 1,000 gpm flow requires 120,000 gallons of volume. The existing storage at Overton exceeds the required volume of 140,000 gallons.

Exterior placement of the flocculator, clarifier, and filter has resulted in several operational and maintenance problems. Algae blooms have developed in the open units; though this has been controlled with the use of plywood covers. The automatic valves used to control the backwash cycle have frozen. Although extreme low temperatures are infrequent, the problem must be eliminated to provide uninterrupted operation of the facility. Complete enclosure of the facility would

be a costly modification that would include structural, electrical, and mechanical improvements. Pipe-insulating materials and heat tracing, properly installed, would provide the necessary protection during the extreme low temperatures.

Five and a half million gallons of water were pumped at Overton Beach in 1988. Monthly average and peak usage was 15,000 gpd (10 gpm) and 50,900 gpd (35 gpm), respectively. The water treatment plant design capacity is 150 gpm.

TABLE 16
OVERTON BEACH WATER USE

MONTH	WATER USE (MG)
JANUARY 1988	0.322
FEBRUARY 1988	0.430
MARCH 1988	0.395
APRIL 1988	0.335
MAY 1988	0.438
JUNE 1988	0.469
JULY 1988	0.546
AUGUST 1988	0.523
SEPTEMBER 1988	0.523
OCTOBER 1988	0.724
NOVEMBER 1988	0.443
DECEMBER 1988	0.403

Projected average and peak monthly water demand of 17,250 gpd (12 gpm) and 58,500 gpd (40 gpm) will easily be handled by the Overton Beach water treatment and distribution system.

Records indicated that only 50%, or 2.75 million gallons, of treated water is used for irrigation at Overton Beach. Annual cost of irrigation is estimated at $61,700. This is related to the minimal amount of vegetation planted throughout the development. The newly constructed facilities incorporated a water conservation landscape design significantly lowering irrigation requirements.

WASTEWATER SYSTEM

Wastewater for the entire area collects at the packaged lift station located near the campground. The underground lift station is a dry-pit/wet well type station. It contains four 110 gpm centrifugal pumps. Two pumps are operated in series to lift sewage from the wet well to the lagoons.

Flow is estimated from the pump run time and the wet well volume. A magnetic flow meter was installed on the effluent pipe but has been abandoned. The meter reads percentage of flow rather than the actual flow.

The average and peak monthly flows are 7,700 gpd and 11,000 gpd. The monthly flows are summarized in the following table:

TABLE 17
OVERTON BEACH WASTEWATER FLOWS

MONTH	AVERAGE FLOW (MGD)
AUGUST 1988	0.012
SEPTEMBER 1988	0.011
OCTOBER 1988	0.009
NOVEMBER 1988	0.007
DECEMBER 1988	0.005
JANUARY 1989	0.007
FEBRUARY 1989	0.007
MARCH 1989	0.008
APRIL 1989	0.010
MAY 1989	0.008
JUNE 1989	0.008

The 1.3-acre treatment and disposal facility consists of four lagoons constructed in 1981. Biological wastewater treatment is provided in an aerated lagoon. Raw sewage is normally piped to the 0.34-acre lined aerated lagoon. Air is provided by a 7-1/2 hp floating turbine aerator.

The second 0.34-acre unlined lagoon is used for biological stabilization and evaporation. Effluent can overflow to the two unlined lagoons for percolation and evaporation of high flows during peak visitation.

Influent BOD has ranged from 174 mg/l to 521 mg/l. Average organic loading to the aerated pond is 121 lbs. BOD per acre per day. Detention time for average conditions is 46 days.

RECOMMENDED IMPROVEMENTS

WATER SYSTEM

With a few exceptions, the water utilities at Overton Beach are well maintained and operating well. It is recommended that the exterior valves at the water plant be insulated and heat traced to prevent freezing. It is estimated that the work would cost $9,000.

The intake pump should be removed and inspected to determine the source of the vibrations. Cost to remove, repair, and possibly replace the submerged pump is estimated at $30,000

In summary, the water improvements at Overton Beach total $39,000 and include:

- o Repair/replace raw water pumps @ $30,000 (OBW1)
- o Installation of heat tracing tapes on the filter valves @ $9,000 (OBW2)

WASTEWATER SYSTEM

Projected average and peak monthly wastewater flows for Overton Beach are 9,200 gpd, and 13,000 gpd respectively. The lift station is sized to handle the anticipated flow. The magnetic flow meter in the sewage lift station should be modified to measure flow directly. It is estimated that this minor modification will cost $5,000.

The surface area required for the projected flow is estimated at 1.1 acres which will be accommodated with the existing 1.3 acre facility.

The park should purchase a portable generator for use during power outages since the distance to the Boulder Beach portable generator is not feasible. Estimated cost of the generator is $25,000.

In summary, the wastewater improvements at Overton Beach will cost $ 30,000 and include:

- o Improvements to the magnetic flow meter @ $5,000 (OBWW1).
- o Purchase a portable generator @ $25,000 (OBWW2)

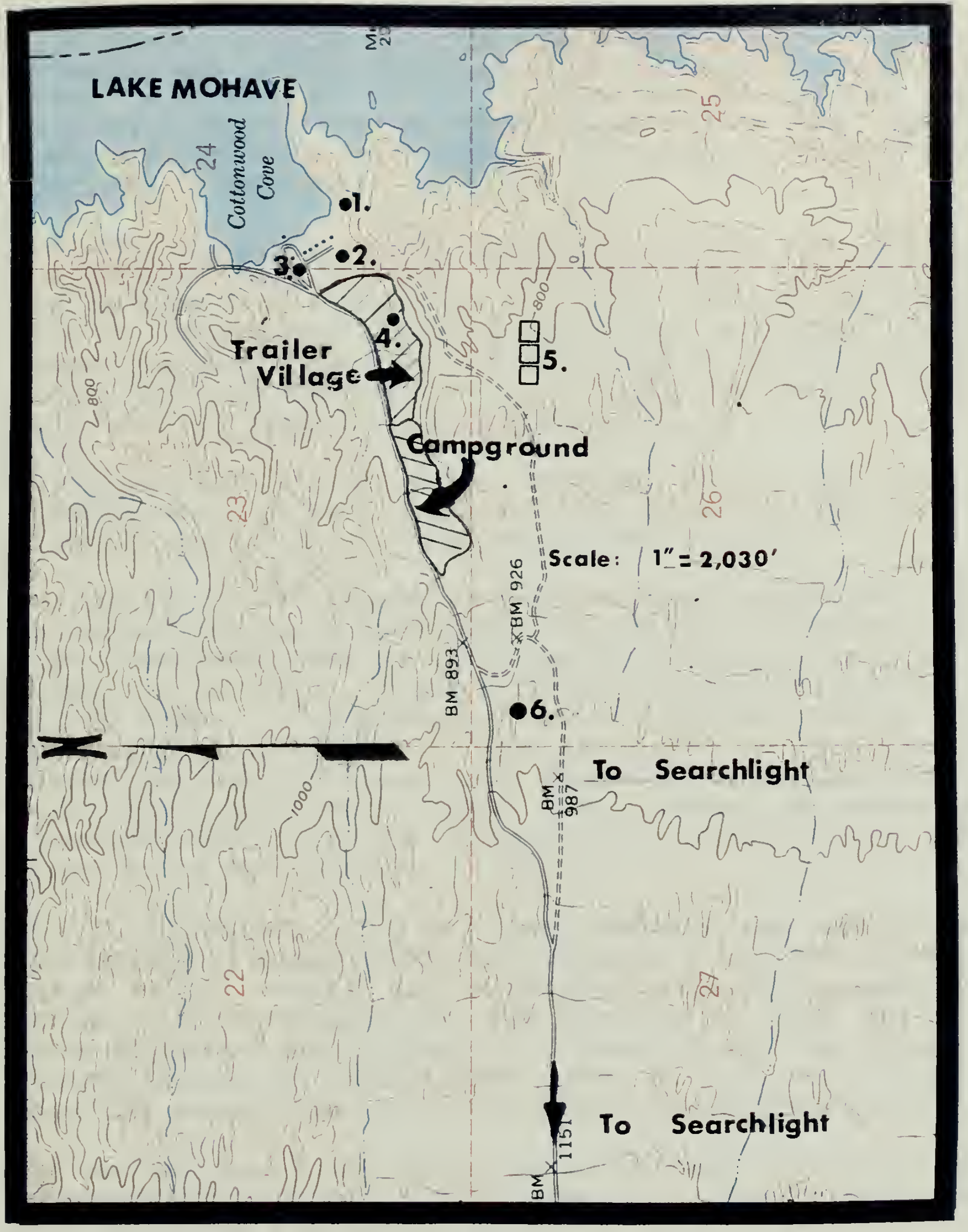
COTTONWOOD COVE

SITE DESCRIPTION

Cottonwood Cove is located on the west shore of Lake Mohave, 14 miles east of Searchlight and 56 miles south of Boulder City. Like other Lake Mead developments, the main attraction is the marina and related shoreline development.
The area is primarily used by recreational boaters during the summer months while fall use is related to fishing. The marina presently provides 206 slips but has the potential to expand to a total of 535 slips under the General Management Plan. The concessioner-operated rental service offers houseboats, pontoons, and motor boats for guests to charter. A boat dump station is provided to collect marine traffic waste; it is then pumped to the main collection system.

A service station, 20-seat restaurant, and general store are also located at the marina.

Cottonwood Cove serves both destination and day use visitors. The park maintains a 149-site campground for overnight visitors. The concessioner operates a 24-unit motel for short term accommodation. A 300-site trailer village for permanent/long term visitation is also available on a lease or purchase arrangement.



KEY

Water Well No. 3	1
Water Well No. 1	2
Lower Lift Station	3
Upper Lift Station	4
Sewage Lagoons	5
Water Tank	6

COTTONWOOD COVE

SITE PLAN

WATER SYSTEM

Groundwater aquifers are used to supply potable water at Cottonwood Cove. The primary well, No. 3, was installed in 1969. Water is drawn through a 10-inch diameter casing pipe sunk to a depth of 200 feet by an 18-stage 100-hp centrifugal pump. The pump capacity is 350 gpm. A desander removes sand from the pump inlet line.

A second well, No. 1, was installed in 1984 and is located at the edge of Lake Mohave. Water is drawn through a 12-inch casing pipe from a depth of 150 feet. The 100-hp centrifugal pump is capable of pumping at a rate 500 gpm. Staff has requested that a desander be installed at this well due to the amount of sand being drawn up through the casing. This well is primarily used as the back up well.

Chlorine gas mixed with treated water is used as a disinfectant at both wells. The chlorine gas is injected directly into the well casing at well no. 3.

Two wells at Cottonwood Cove have been abandoned. One was abandoned due to insufficient capacity; the other well, no. 2 was abandoned due to poor water quality. Well no. 2 was installed in 1973. It has a 10-inch casing drilled to a depth of 250 feet. It originally used a 600 gpm, 125-hp, 21-stage turbine pump. Well no. 2 was abandoned in 1984 due to high concentrations of fluoride. Fluoride concentrations of 4.5 mg/l were measured in 1984. No further evidence of high fluoride levels in the remaining two active wells has been found since that time.

The distribution line located between the well house and storage tanks perpendicularly crosses a section of the sewage force main. Staff has expressed concern regarding cross contamination between the two systems at this point. The water line is approximately 2 feet above the sewage line. Contamination of the water line is unlikely due to the physical separation and the operating pressures of both lines.

Two aboveground steel water tanks are used for water storage. One tank provides 100,000 gallons of storage volume; the other tank provides a storage volume of 200,000 gallons. Future domestic water storage requirements for Cottonwood Cove will require 282,900 gallons to meet the 24-hour average daily demand. A two-hour 1,000-gpm fire flow will require a fire

storage volume of 120,000 gallons. The available water storage will not provide the projected storage volume of 402,900 gallons. An additional 100,000 gallons of storage volume will be required at Cottonwood Cove.

Ninety million gallons of water were pumped at Cottonwood Cove during 1988. Daily average water use in 1988 was 246,000 gpd (170 gpm). Peak monthly average was 388,600 gpd (270 gpm).

TABLE 18
COTTONWOOD COVE WATER USE

MONTH	WATER USE (MG)
JANUARY 1988	4.206
FEBRUARY 1988	4.597
MARCH 1988	8.648
APRIL 1988	7.408
MAY 1988	-
JUNE 1988	10.461
JULY 1988	11.003
AUGUST 1988	11.312
SEPTEMBER 1988	11.657
OCTOBER 1988	4.872
NOVEMBER 1988	8.744
DECEMBER 1988	7.324

WASTEWATER SYSTEM

Sewage from the motel, marina, concessioner businesses, and a portion of the trailer village is collected at the lower lift station. The underground- type, dry-pit/wet well station has a capacity of 190 gpm. This lift station is frequently out of service as a result of power outages. The lift station is located adjacent to Lake Mohave. The proximity of the lake poses a potential health risk if a sewage overflow should occur.

Sewage is pumped to a second lift station located in the trailer village. Waste from the campground and a portion of the trailer village collects at this pump station for the final lift to the lagoons. The wet well concrete wall has deteriorated due to severe hydrogen sulfide attack. Hydrogen sulfide is a typical sewage byproduct produced by microorganisms found in sewage. Hydrogen sulfide production is typically found in low velocity sewers, wet wells, and drop structures. Associated conditions include low dissolved oxygen levels and high biochemical oxygen demand.

Chunks of concrete have been sucked into pumps, requiring a significant amount of maintenance over the last year.

Sewage flow from the final lift station is estimated based on the wet well volume and total equipment run time. The station has a capacity of 220 gpm. Peak flows of 190 gpm are anticipated. Upgrading the station to meet the future flows is recommended. It is also recommended that the existing wet well be abandoned.

A summary of the monthly flows are listed in the table below.

TABLE 19
COTTONWOOD COVE WASTEWATER FLOWS

MONTH	AVERAGE FLOW (GPD)
AUGUST 1988	0.042
SEPTEMBER 1988	0.044
OCTOBER 1988	0.035
NOVEMBER 1988	0.026
DECEMBER 1988	-
JANUARY 1988	0.010
FEBRUARY 1988	0.015
MARCH 1988	0.018
APRIL 1988	0.019
MAY 1988	0.021
JUNE 1988	0.059
JULY 1988	0.037
AUGUST 1988	0.029

Sewage from the lift station is pumped to the wastewater lagoons used for treatment and disposal. The three lagoons have a total surface area of 7.5 acres. Lagoon no. 1 is a 2.5-acre lagoon which has not been used for several years. As a result, the liner has deteriorated beyond repair. Treatment is presently limited to lagoon no. 2. This 3.5-acre lagoon is loaded at a rate of 40 lbs. BOD per acre per day.

Two 1.5-hp aerators are used to disperse air in the 2.5-acre lagoon. The State of Nevada Department of Environmental Protection requires a minimum of 0.1 hp per 1,000 cf of volume for aerated lagoons. This equipment provides only 0.005 hp per 1,000 cf of volume. The aerators are so grossly undersized for the volume being aerated that they ineffective. The membrane liner of lagoon no. 2 has numerous tears and should be replaced

Effluent from the lagoon overflows to the third, unlined, 1.5-acre lagoon.

RECOMMENDED IMPROVEMENTS

WATER SYSTEM

A domestic water demand of 282,900 gpd (196 gpm) is projected for future conditions at Cottonwood Cove. Both wells have adequate capacity to meet the projected demand. An additional 100,000 gallons of storage volume will be required to meet the anticipated domestic demand and fire flows. There is adequate land adjacent to the existing tank for the new tank. The estimated construction cost of an aboveground 100,000-gallon tank and miscellaneous pipe connections is $272,000.

The exteriors of both existing tanks are in good condition. It is recommended that an internal inspection be conducted to determine the condition of the interior tank surface. Estimated cost for the inspection is $10,000.

The park would operate well no. 4 more frequently if sand contamination of the water was reduced. There is an abandoned desander at well no. 2 that should be relocated to well no. 4. Estimated cost for this work is $15,000.

In summary, the total cost of water improvements at Cottonwood Cove is $297,000 and includes:

- Construction of a 100,000-gallon water tank @ $272,000 (CCW1)
- Inspection of the existing tank interior surface @ $10,000 (CCW2)
- Relocation of the desander from well no. 2 to well no. 4 @ $15,000 (CCW3)

WASTEWATER SYSTEM

Projected annual average and peak month flows for Cottonwood Cove are estimated at 34,000 gpd and 50,000 gpd, respectively. The upper lift station is undersized to handle the anticipated flows. The lift station manufacturer has gone out of business, making it difficult to obtain replacement parts. Both lift stations should be replaced. Estimated construction cost for the replacement of each lift station is $138,000 or a total of $276,000 for both.

As discussed previously, the aerator hp/lagoon volume ratio is significantly undersized and ineffective in enhancing biological activity in the 3.5-acre lagoon. To provide the proper air/lagoon volume, larger aeration equipment should be installed or the lagoon should be reconfigured to reduce the volume.

It is recommended that the 2.5-acre lagoon be reconfigured to two 1.15-acre lined lagoons with raw sewage directed to either 1.15-acre lagoon. New floating aerators, sized for 0.1 hp per 1,000 cf of volume, would be installed. Lagoon effluent would be settled in the existing 3.5-acre lagoon. Overflow would evaporate or percolate from the final 1.5-acre lagoon. The construction cost for reconfiguration, replacement of all liners, and miscellaneous piping is estimated at $825,000.

Cottonwood Cove is approximately 1-1/2 hours from either Katherine or Boulder City, the location of the park's emergency generators. The travel distance to either location exceeds one hour. The park risks overflow and contamination of the lake at the lower lift station. It is recommended that a 30 KW emergency generator be provided exclusively for Cottonwood Cove for use during power outages. Estimated cost for the generator is $25,000.

In summary, the total cost for wastewater improvements at Cottonwood Cove is $1,126,000 and includes:

- Replace two sewage lift stations @ $276,000 (CCWW1)
- Reconfigure lagoons, install new lining, and replace surface aerator at existing lagoons @ $825,000 (CCWW2)
- Purchase a portable generator @ $ 25,000 (CCWW3)

KATHERINE

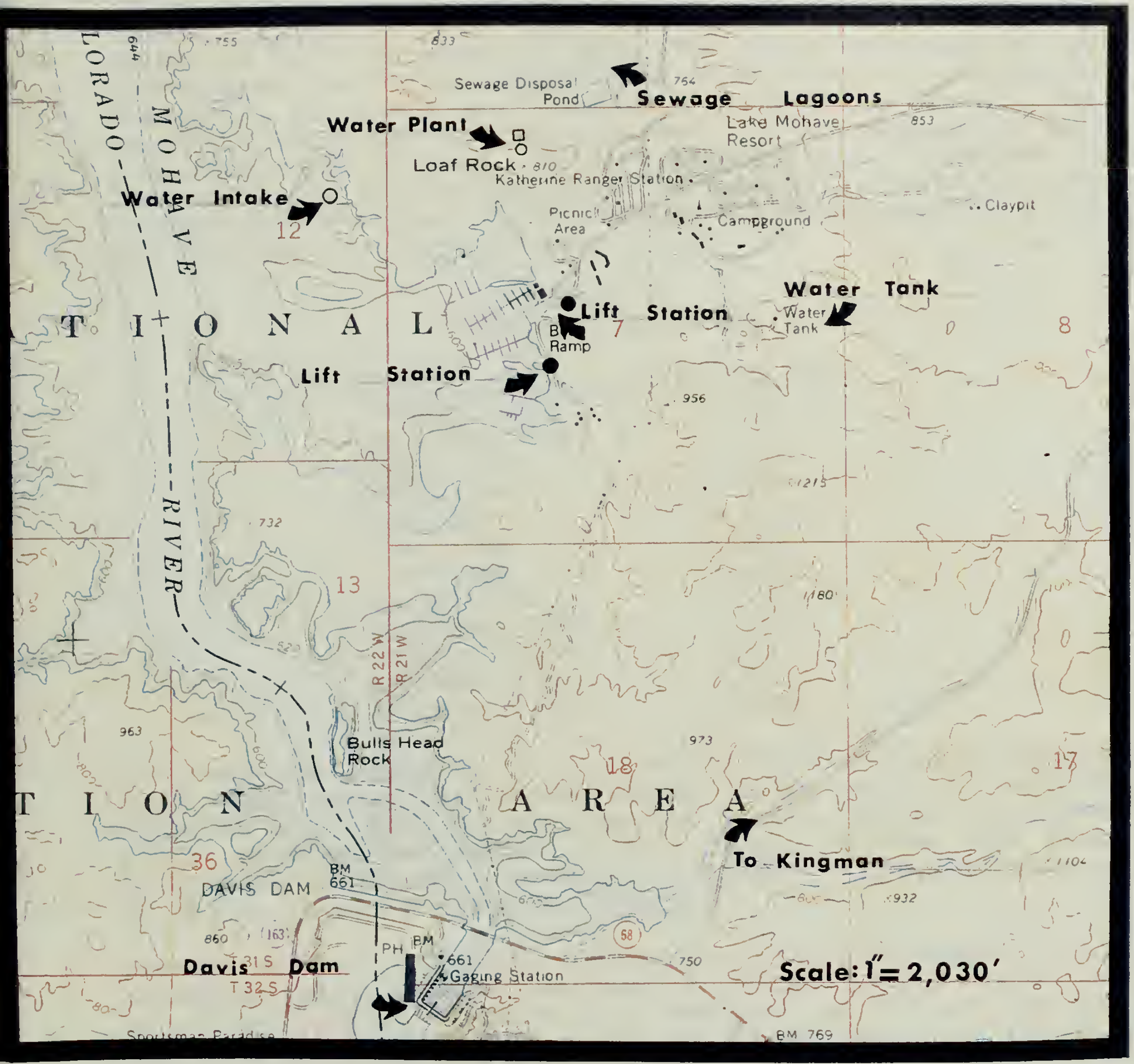
SITE DESCRIPTION

Katherine is located at the southern edge of the recreational area on Lake Mohave, just upstream of Davis Dam. One of the nation's most rapidly growing cities, Laughlin, Nevada, is within five miles of the development. Katherine has experienced rapid growth, estimated at 28% over the last ten years, which is significantly higher than any other development within the recreational area. This growth is attributed to the casino related businesses found at Laughlin.

The marina currently provides 764 slips. The concessioner rental service provides 75 houseboats and pontoon boats. One of the most serious problems at the marina area is circulation. Limited access to the marina creates major congestion during periods of high visitor use. The park has requested the Denver Service Center investigate options to improve traffic flow to the marina or augment launching facilities at one of the nearby coves. This proposed development is consistent with the park's General Management Plan. The existing utility systems will not be extended to serve these new areas.

The park operates a 173-site campground near the marina. The concessioner operates a trailer village with 104 long term and 39 short term sites. A 52-unit motel is also available for overnight visitors. Concessioner-operated services that support the marina include a service station, restaurant, and general store.

Private residences have been constructed on leased land north of the development. This community, referred to as Katherine Cabin Sites, is served by a separate well system and community sewage system.



KATHERINE
SITE PLAN

WATER SYSTEM

Raw water is obtained from an isolated cove on Lake Mohave, approximately 70 feet below the water plant. Water quality from this source has been excellent; average influent turbidity was 0.58 ntu's in 1988. The water is pumped by two end suction centrifugal pumps with capacities of 500 gpm and 250 gpm. The pumps are located on a floating barge. The barge pontoons and deck have rusted. Also, several of the pipe floats are missing. Total water pumped at Katherine in 1988 was 90.85 million gallons. Average daily water use was 253,300 gpd (176 gpm). A peak monthly water demand of 429,000 gpd (298 gpm) occurred in June 1988.

TABLE 20
KATHERINE WATER USE

MONTH	WATER USE (MG)
JANUARY 1988	3.767
FEBRUARY 1988	3.710
MARCH 1988	6.224
APRIL 1988	3.547
MAY 1988	8.402
JUNE 1988	11.108
JULY 1988	13.301
AUGUST 1988	11.189
SEPTEMBER 1988	9.725
OCTOBER 1988	8.933
NOVEMBER 1988	5.980
DECEMBER 1988	4.963

The water is pumped to a 0.35 mgd filtration plant located on a bluff above the intake barge. Raw water is settled first in an 18-foot 6-inch diameter basin. Polymer is added prior to the dual media filter. The average and peak filtration rates are 1.1 and 2.1 gpm/sf. Filter effluent turbidity levels average 0.19 ntu's.

Treated water is stored in a 500,000-gallon aboveground water treatment tank. Domestic storage will require 290,000 gallons of volume. Fire storage will require 120,000 gallons of volume. The future storage volume requirement of 410,000 gallons will be provided by the existing water tank.

The distribution system requires the installation of two new fire hydrants to provide adequate coverage of the development. One hydrant should be located near the new maintenance facility. The second hydrant is to be located on a campground loop.

WASTEWATER SYSTEM

Sewage from the restaurant, service station, general store, and the marina holding tank is collected at the marina lift station. The aboveground suction lift type station has a pumping capacity of 100 gpm. Sewage is lifted to the main station, located near the fish grinder station, east of the main marina parking lot.

Sewage from the campgrounds, staff residences, and trailer village, as well as that from the lower station, is collected at this lift station. A 10,000-gallon underground fiberglass tank was installed to provide overflow relief at the main lift station in the event of a power outage. The main lift station has a pumping capacity of 225 gpm. Present peak flows to the lift station are estimated at 120 gpm. Projected peak flows of 150 gpm are anticipated. The present capacity can accommodate both flows.

The main lift station lacks a flow-metering device. The park intends to install an elapsed time recorder to monitor the development's sewage flows. The average flow was estimated to be 27,700 gpd. It was predicted using current visitation data, knowledge of existing facilities, and a unit value for wastewater generation.

Sewage is pumped approximately 3,000 feet to the 3.5-acre lagoon site. The site was constructed in 1981. Mechanical aeration is provided to the first lagoon, a 0.75-acre membrane-lined lagoon. The two 1-1/2 hp aerators are grossly undersized to deliver the required air for the lagoon volume. The aerators should be replaced with a large 7 hp aerator.

Further stabilization and settling take place in a 0.75-acre membrane-lined lagoon. A third 1.5-acre bentonite-lined lagoon is piped to accept settled effluent. A fifth 0.5-acre unlined lagoon was constructed by the park to handle the high flows seasonal. The Arizona Department of Health has requested that the unlined pond be enclosed with a perimeter fence.

RECOMMENDED IMPROVEMENTS

WATER SYSTEM

The intake barge floats and deck have rusted throughout. The two pumps used to lift raw water to the water treatment plant should be overhauled or replaced since little preventive maintenance has been completed. The 250-gpm capacity pump is not capable of meeting future water demands and should be replaced. It is recommended that the entire barge be replaced; estimated construction cost is $85,000.

The exterior surface of the water storage tank has rusted. It is recommended that it be repainted at an estimated cost of $20,000. The interior of the water tank has not been inspected. It is also recommended that the interior surface be inspected to determine any defects and to establish any recommendations for rehabilitation. Cost of this work is estimated at $5,000.

A section of the campground requires approximately 500 feet of pipe and a hydrant to complete fire coverage of the area. It is estimated that the construction cost of this work will be $16,000. In addition, a fire hydrant should be installed at the new maintenance facility for an estimated cost of $16,000.

In summary, the total cost of water improvements at Katherine will be $142,000 and includes:

- Replacement of the water intake barge @ $85,000 (KW1)
- Repainting the water tank exterior estimated @ 20,000 and inspection of the water tank interior @ $5,000 for a total of $25,000 (KW2)
- Installation of a hydrant in the campground @ $16,000 (KW3)
- Installation of a hydrant at the maintenance facility @ $16,000 (KW4)

WASTEWATER SYSTEM

The existing lagoons will not accommodate future wastewater flows. It is recommended that an additional 1.25-acre lagoon be constructed. The nonaerated lined lagoon is estimated to cost $990,000.

It is recommended that the park install a perimeter fence to enclose the percolation pond. Estimated cost for the fence is $20,000.

In summary, the total cost for wastewater improvements at Katherine is $1,101,000 and includes:

- Construction of 1.0 acre nonaerated lagoon @ $990,000 (KWW1)
- Enclosure of the percolation pond @ $20,000 (KWW2)

WILLOW BEACH

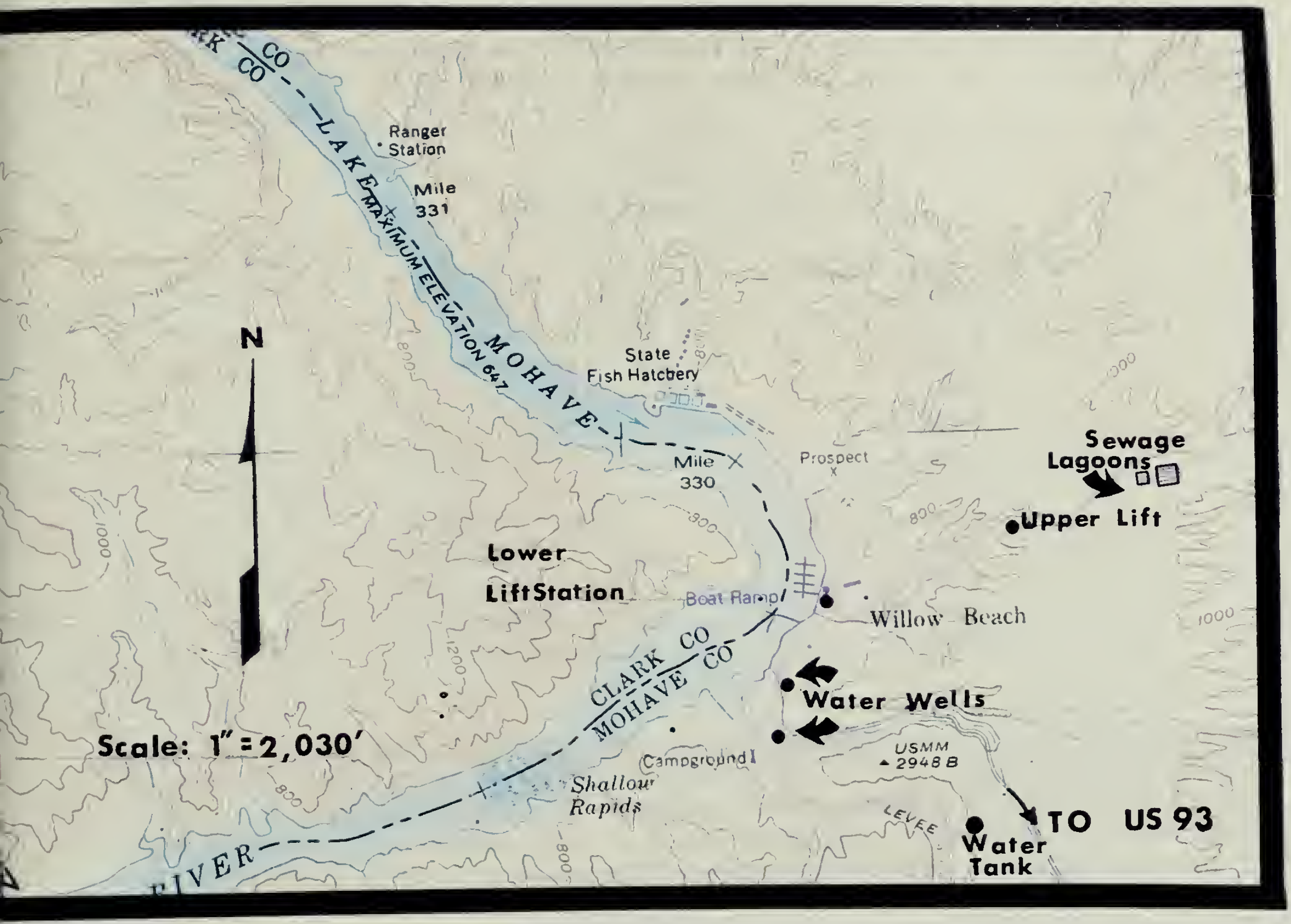
SITE DESCRIPTION

Willow Beach, located in the picturesque Black Canyon, is 20 miles south of Boulder Beach and 81 miles north of Katherine. Water temperature is a constant 55° F which attracts fisherman to the area.

The canyon in which the area is located has a high potential of flash flooding. The area had a severe flood in 1978, after which the campground was closed.

The park is presently working with the U.S. Bureau of Reclamation on a design for flood mitigation for the entire development. The initial plans include relocation of the 78-site trailer village east to higher ground. A flood diversion structure will protect the existing 24-unit motel. No modifications to the 100-seat restaurant and store will be required. Park housing has been abandoned because of its location in the floodplain. Several locations for new housing are being explored. Land for a new campground is limited near the lakeshore. Relocation out of the wash is being considered.

The marina currently provides 182 slips. The General Management Plan allows expansion of the marina to 270 slips. The concessioner operates a boat rental with 20 houseboats available.



WILLOW BEACH

SITE PLAN

WATER SYSTEM

Total water pumped for 1988 was 24.2 million gallons. Daily average and peak water usage was 66,300 and 462,000 gpd, respectively.

TABLE 21
WILLOW BEACH WATER USE

MONTH	WATER USE (MG)
JANUARY 1988	0.668
FEBRUARY 1988	0.800
MARCH 1988	1.361
APRIL 1988	1.360
MAY 1988	1.454
JUNE 1988	1.811
JULY 1988	3.618
AUGUST 1988	3.499
SEPTEMBER 1988	2.885
OCTOBER 1988	2.873
NOVEMBER 1988	1.950
DECEMBER 1988	1.919

Raw water is provided to the development by two wells located near the Colorado River. Well No. 1, the dedicated primary well, is located several hundred feet east of the river bank. The submersible pump has a firm pumping capacity of 300 gpm. It replaced a smaller capacity pump in 1986. Chlorine gas is injected into the 12-inch well casing to provide disinfection.

The back up well has a firm pumping capacity of 250 gpm. The well is located at the shore of Colorado River. The 8-inch well casing was installed in 1956. No emergency power is available to operate in event of a major power failure.
It is recommended that a portable generator be purchased for use at the development because of the remoteness of the facility. The generator would be sized to operate equipment for either the water or wastewater facilities.

Treated water storage for 200,000 gallons is provided in an aboveground welded steel tank. Fire storage requires 120,000 gallons of storage; future domestic storage will require 76,000 gallons. Total water storage required at Willow Beach will be 196,000 gallons.

WASTEWATER SYSTEM

Sewage from the Willow Beach development is collected at the lift station located on the shore of Lake Mohave. An abandoned submersible lift station served staff housing. Sewage from the U.S. Fish and Wildlife Hatchery is pumped to a gravity line that also drains to the shoreline lift station.

The underground package lift station contains four 110 gpm pumps. Two pumps operate in series to lift sewage up to a second lift station. The second lift station is located between Lake Mohave and the sewage lagoons. Wastewater is pumped from this lift station directly to the sewage lagoons.

Biological treatment is accomplished in a 0.7-acre, aerated membrane-lined lagoon. The park does not monitor influent sewage flow and strength. The wastewater is further stabilized in a second 0.5-acre membrane-lined lagoon. Effluent from the second lagoon overflows to an adjacent wash throughout the year.

The original design included land application of lagoon effluent to augment evaporation. Lagoon effluent was disposed to a 5-acre spray irrigation site adjacent to the lagoons as recently as three years ago. The lagoon effluent was disinfected using sodium hypochlorite before being pumped to the spray system. The irrigation system does not comply with the revised regulations for land application for operation in the State of Arizona.

RECOMMENDED IMPROVEMENTS:

Significant changes to the present layout of Willow Beach is being considered by the park, regional office, the Denver Service Center, and the U.S.Bureau of Reclamation. The proposed relocation of the trailer village, construction of new staff housing, and construction of a new campground will have significant impact on the area's utility systems. Regardless of the outcome of the proposed improvements, the following items are to be addressed.

- Abandoning the primary water pump located in Jumbo Wash.
- Relocation of the Trailer Village.
- Flood mitigation structures for the motel.
- Construction of a new campground.
- Relocation of the sewage lagoons.
- Construction of new employee housing.

WATER SYSTEM

?

Both wells are located in Jumbo Wash, within the 100 year floodplain. A new well site outside Jumbo Wash should be constructed. Potential locations for a second well would be one of the small coves east of the road between the fish hatchery and main development. It is recommended that Well no. 2 be left in Jumbo Wash as the backup well and pump house.

The pump from well no. 1 will be relocated to well no. 2. Chlorine solution is injected into the pump casing at both locations. The piping will be modified to inject in the discharge line in both the new and standby pump stations. Estimated cost for drilling a new well, construction of a new pump house, and connection to the water system is estimated at $160,000.

The treated water storage tank is located within the 100 year floodplain and should be relocated outside Jumbo Wash. Final site selection should be based on the location of the new campground and relocation of the trailer village. Estimated cost for a new 200,000-gallon tank, access road, and connection to the water system is estimated at $575,000.

In summary, the total estimated cost for improvements to the present Willow Beach development is $735,800 and includes:

- Relocating the water storage tank @ $575,000 (WBW1)
- Relocating well out of Jumbo Wash and constructing a new pump house @ $160,800 (WBW2)

WASTEWATER SYSTEM

The present sewage lagoons are hydraulically overloaded. It is recommended that a 1-acre lined lagoon be constructed to augment the present treatment capacity. Construction of the lagoon is estimated to cost $800,000. The spray irrigation site should be abandoned to comply with the current regulations of the State of Arizona. Estimated cost of the work is $30,000.

The manufacturer of the lift station has gone out of business, making it difficult to obtain spare equipment parts. Both lift stations should be replaced with aboveground suction lift type stations. Estimated construction cost of the replacement is $138,000 per station, or $276,000.

Finally, due to the remote location of Willow Beach, it is recommended that the park purchase an emergency generator to power the lift stations during power outages. In summary, the cost of wastewater improvements at Willow Beach total $1,131,000 and includes:

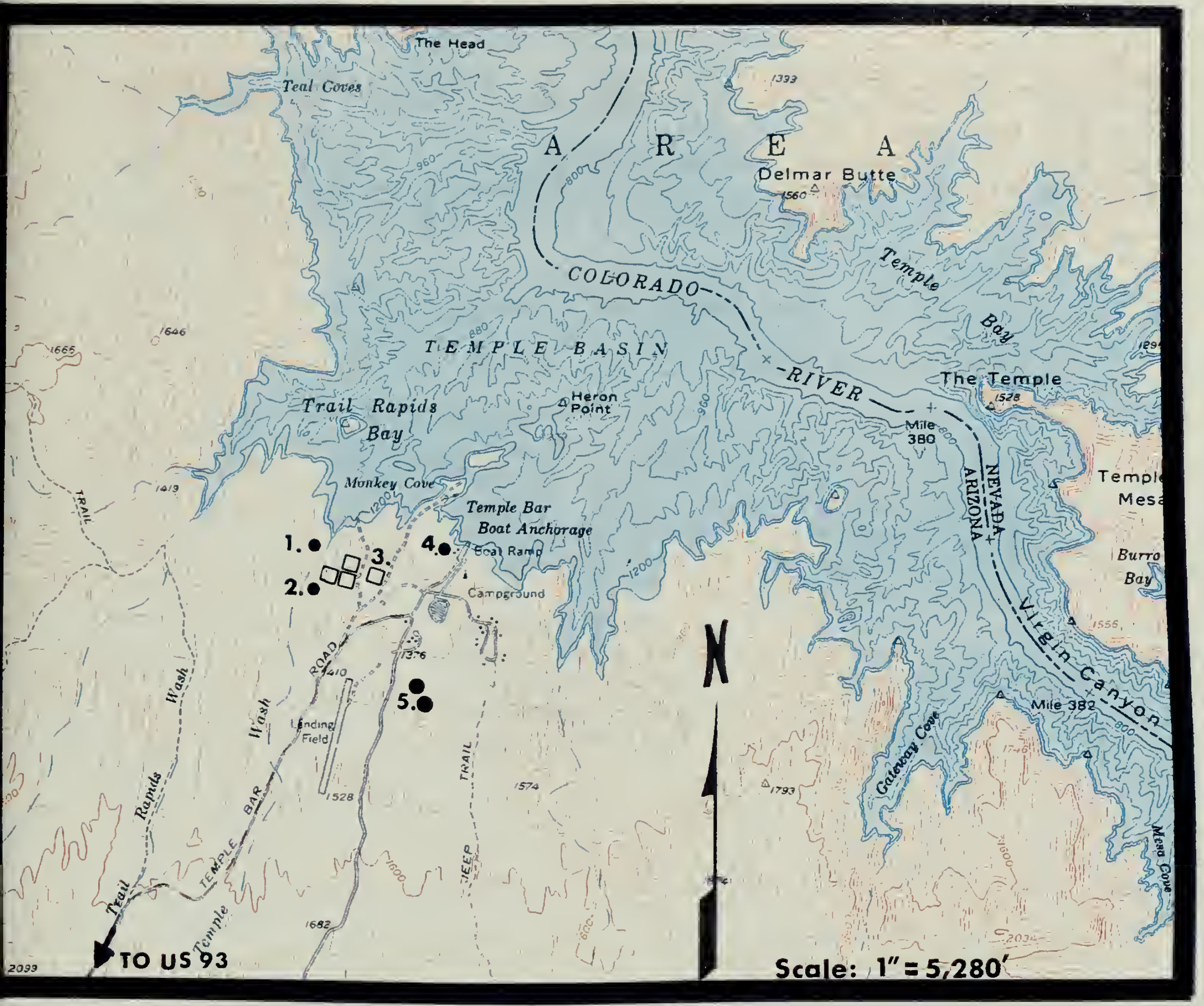
- Construct a 1-acre sewage lagoon and demolish the existing spray field @ $830,000 (WBWW1)
- Replace existing lift station @ $276,000 (WBWW2)
- Purchase an emergency generator @ $25,000 (WBWW3)

TEMPLE BAR

SITE DESCRIPTION

Temple Bar is a remote development at the eastern edge of Lake Mead. Located 48 miles east of Boulder Beach, the development is primarily a destination area. Visitation to Temple Bar is the lightest in the recreational area. Records indicate that visitation is increasing at a rate of 2% annually. Like other Lake Mead developments, the marina is the prime attraction. The marina has a 64-slip dock, with a potential to increase slips up to 980, according to the General Management Plan. A concessioner operates a boat rental, presently limited to 15 boats.

Overnight facilities include a 22-unit motel operated by a concessioner. The 116-unit trailer park offers permanent residence at the lake and is operated by the concessioner. Permanent residences have been constructed just east of the developed area. The Temple Bar cabin sites consist of 36 houses constructed on leased property. It is anticipated the land will be returned to the Park Service upon expiration of the lease. The park maintains a 153-site campground at Temple Bar. This area is unlike other campgrounds discussed due to its remoteness, and is used primarily by the destination visitor.



KEY

Water Well No. 3	1
Water Well No. 4	2
Sewage Lagoons	3
Lift Station	4
Water Tanks	5

TEMPLE BAR

SITE PLAN

WATER SYSTEM

A groundwater source is used for treated water at the development. Total water pumped at Temple Bar in 1988 was 78.5 million gallons. Daily average water usage was 215,100 gpd (149 gpm). A peak monthly water demand of 340,935 gpd (236 gpm) occurred in July 1988. A summary of the monthly water records from 1988 is summarized below.

TABLE 22
TEMPLE BAR WATER USE

MONTH	WATER USAGE (MG)
JANUARY 1988	1.838
FEBRUARY 1988	3.182
MARCH 1988	5.153
APRIL 1988	5.155
MAY 1988	7.609
JUNE 1988	9.476
JULY 1988	10.569
AUGUST 1988	7.532
SEPTEMBER 1988	7.856
OCTOBER 1988	8.695
NOVEMBER 1988	7.094
DECEMBER 1988	4.324

The primary well, constructed in 1983, consists of a 12-inch casing installed to 190 feet. Water is pumped by a 275 gpm centrifugal pump. Chlorine solution is fed directly into the pump casing. A second pump capable of pumping 100 gpm from a second well with a 12-inch casing, 150 feet deep, is used for backup. Staff must move chlorination equipment from the primary well house when the backup well is operated since no chlorination equipment is provided at this location.

Treated water is pumped to two aboveground steel tanks with storage volumes of 100,000 and 500,000 gallons. Staff must access the tanks by foot because they are located approximately 120 feet off the access road. Both tanks have considerable exterior rusting.

Water use is expected to be 170 gpm and 270 gpm for average and peak months, respectively. The existing pumps will handle the anticipated demand. Future domestic and fire storage requirements for Temple Bar are 247,000 and 120,000 gallons, for a total of 367,000 gallons. The existing 600,000 gallons of storage can provide the anticipated storage requirements.

WASTEWATER SYSTEM

The entire collection system drains to a wet well located west of the restaurant. An aboveground suction lift type sewage lift station was installed in 1989. The station has a firm pumping capacity of 250 gpm. A 10,000-gallon underground tank is connected to the wet well for use as an emergency overflow in the event of equipment or power failure.

The lift station pumps sewage approximately 150 feet to the four-cell treatment and disposal facility. The 2.7-acre lagoon facility uses biological stabilization, settling evaporation, and percolation

The sewage is first aerated in a 0.8-acre membrane lined lagoon. Typical operating depth of this pond is 4.0 feet. Settling occurs in the succeeding two 0.72-acre ponds. One lagoon is lined with a membrane material; the other lagoon is lined with bentonite. Operating depth of these ponds typically averages 5 feet. A fourth 0.5-acre unlined pond was constructed by the park. Water level in the last pond varies with the influent flow and prevailing weather conditions. The fourth pond is not enclosed by a perimeter fence.

The average estimated wastewater flow is 24,500 gallon per day for the present facilities. The peak month organic loading was estimated to be 121 lbs./acre/day based on a influent BOD of 350 mg/l. Detention time for average flow is 47 days.

Based on current and projected visitation, annual average flow is anticipated to be 30,000 gpd. A total of 4.2 acres, or an additional 1.5 acres, will be required to treat and dispose of the wastewater volume.

RECOMMENDED IMPROVEMENTS:

WATER SYSTEM

Both steel water storage tanks show external rusting. It is recommended that the exterior surface of both tanks be repainted. The estimated cost of the work is $45,000. It is highly recommended that an interior inspection of the tanks be completed to determine the extent of rust penetration. Estimated cost of the inspection is $10,000. Total estimated cost of tank rehabilitation is $55,000.

The standby water pump does not have capacity to meet the development's future demands. It is recommended that the 100-gpm pump be replaced with a 300-gpm centrifugal pump at an estimated cost of $30,000.

Both wells should be equipped with lightning protection. Recent strikes have damaged equipment and jeopardized water delivery. Estimated cost of this is $10,000.

There is no access road to the water storage tanks. A road to another facility is used by staff to drive to the water tanks. It is recommended that a road be constructed to allow direct access to the tanks. Estimated cost for the road construction is $60,000

In summary, the total estimated cost for water system improvements at Temple Bar is $155,000 and includes:

- Repaint the exterior surface of the existing water tanks; inspect the interior surfaces @ $55,000 (TBW1)

- Upgrade the standby water pump @ $30,000 (TBW2)

- Add lightning protection to water wells @ $10,000 (TBW3)

- Construct an access road to the water tanks @ $60,000 (TBW4)

Park management will work with the concessioner to identify areas of high water use, and develop a water conservation policy.

WASTEWATER SYSTEM

All the lagoon area is presently being used. The development is in critical need of additional sewage lagoon capacity. It is recommended that a 1.5-acre lined lagoon be constructed adjacent to the present site. It is estimated that the lined, nonaerated cell will cost $1,250,000.

It is also recommended that the fourth pond be enclosed with a perimeter fence to comply with the Arizona Department of Health's requirements. Estimated cost for the perimeter fence is $20,000.

Temple Bar is subjected to numerous power outages. It is recommended that an emergency generator be purchased to provide back-up power during these periods. Estimated cost of a 30 KW unit is $25,000.

In summary, the total estimated construction cost for the improvements at Temple Bar is $1,295,000 and includes:

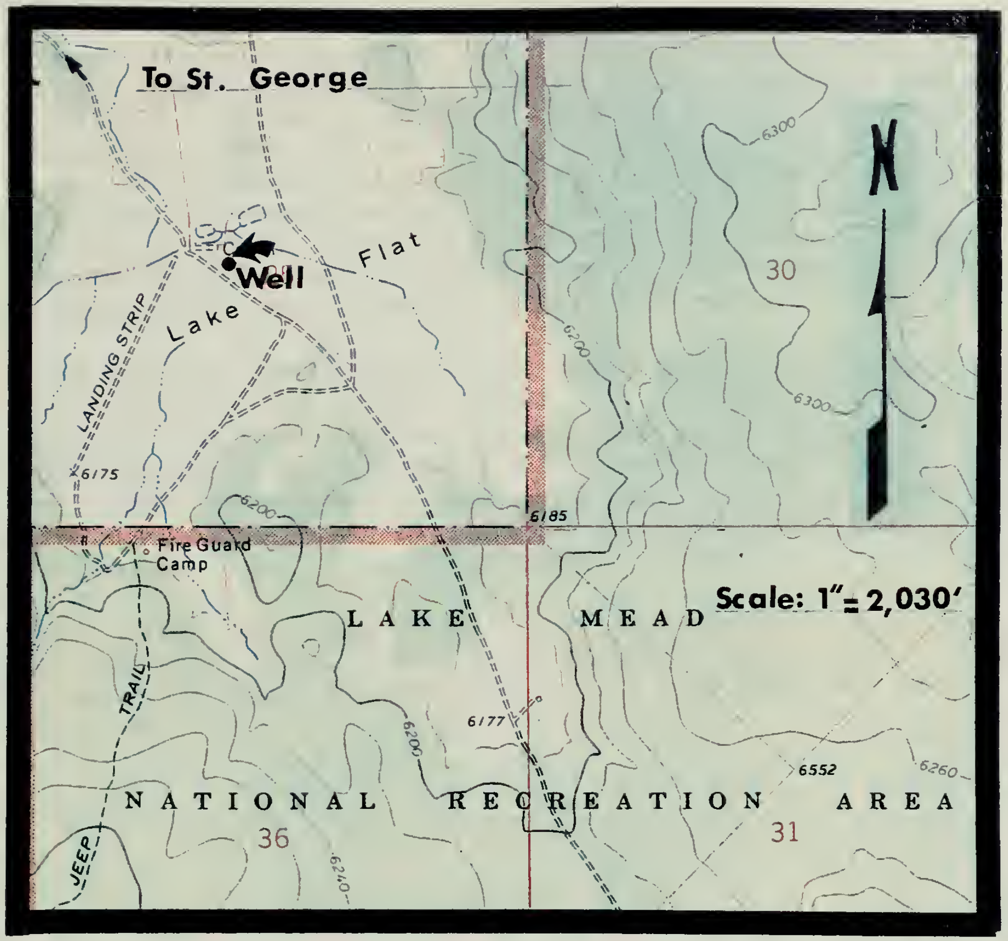
- Construction of a 1.5-acre lagoon @ $1,250,000 (TBWW1)
- Enclose the percolation lagoon with a fence @ $20,000 (TBWW2)
- Purchase of a emergency generator @ $25,000 (TBWW3)

SHIVWITS PLATEAU

SITE DESCRIPTION

The Shivwits Fire Camp is located on a plateau surrounded by the Grand Canyon NP on three boundaries. Access to the area is by a four-wheel drive unimproved road or by plane. The closest city is St. George, Utah, approximately 70 miles northwest.

The area is a fire station staffed with seasonal rangers. The fire watch is operated cooperatively with the Bureau of Land Management for monitoring fire activity on the plateau. Visitation to the Shivwits is primarily park staff and a few hearty hikers.



SHIVWITS PLATEAU

SITE PLAN

WATER SYSTEM

Water for the Shivwits is obtained from a well located 1-1/2 miles north of the ranger fire camp. The well was constructed in 1963. Water is pumped through a four-foot casing from an average depth of 66 feet. The pump is rated at 35 gpm. Limited information relating to the well installation was available. The underlying soils include Malipi clay for the first 25 feet, lava bedrock for the next 20 feet, and clay shale for the next 50 feet. Water has historically been found between the lava and clay shale layers.

The well is powered by a portable diesel generator transported to the site by staff. Water is transported back to the fire station in a 50-gallon tank. The well is not secured, and it is suspected that others may use the well which is on Bureau of Land Management property in an area used for cattle grazing. This may result in a potential risk of groundwater contamination from livestock.

The park has requested that a new well site be evaluated within the Fire Station compound. This would eliminate the risk of potential contamination and improve staff access to the well.

WASTEWATER SYSTEM

The park installed 1,500-gallon septic tank and 1,000 square-foot soil absorption field in 1985. Based on the seasonal operation of the system, it will serve the fire camp for 20 to 25 years.

RECOMMENDATIONS

WATER SYSTEM

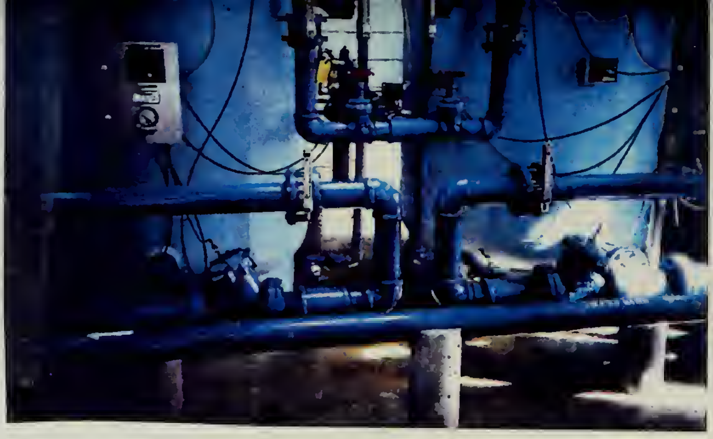
It is recommended that the well be relocated within the boundaries of the Shivwits Fire Camp. Location within the camp will restrict use to park staff. Not only more secure, it will reduce the potential of water contamination from animal-transmitted diseases. Estimated cost for the well relocation is $175,000 (SPW1)

WASTEWATER SYSTEM

The park has requested that a 4-inch diameter two-way cleanout be installed on the tank. This would ensure monitoring of the scum levels, a good preventative practice. Estimated cost for the cleanout is $2,500.

APPENDIX A

Surface water floating intake barge at Callville Bay.



Pressure filters at Las Vegas Wash.

Typical package water treatment plant.

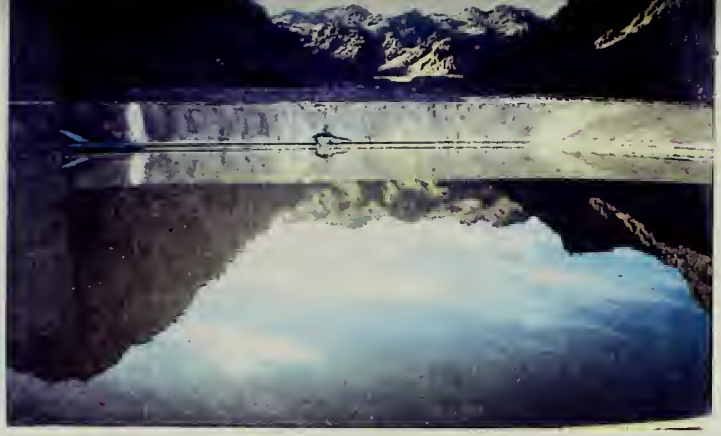
Insulated exterior water piping at Overton Beach.

Temple Bar water tank. Note distance from access road.

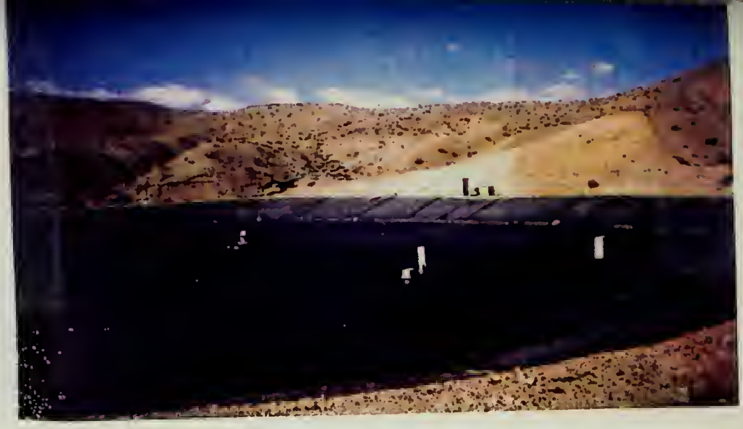
Typical polymer mixing and feed at water treatment plant.

Existing well at Shivwits Plateau.

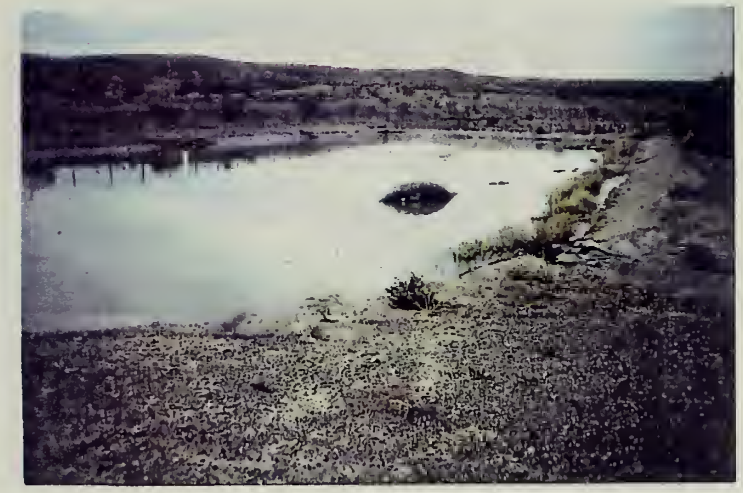
Proposed site for new well at Shivwits Plateau.



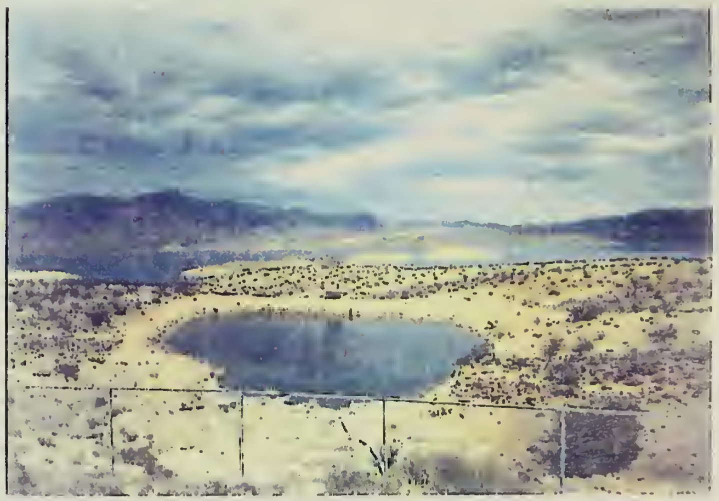
Concrete lined lagoons at Boulder Beach.



Membrane lined lagoons at Overton Beach.



Membrane lined lagoons at Las Vegas Wash.

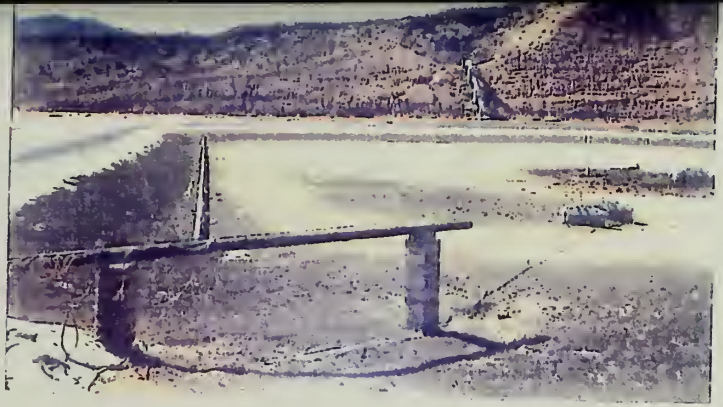


Fifth lagoon located outside fenced area at Temple Bar.

Typical example of a suction lift type pump station. This specific station is located at Katherine.

Typical access for flooded suction, package lift station.

Roto-phase converter used to convert single phase power to three phase power.



Revised lagoon inlet piping at Echo Bay.

Lagoon effluent spray disposal field at Willow Beach.

Seasonal lagoon effluent overflow at Willow Beach.

APPENDIX B

RICHARD H. BRYAN, Governor

istration 702/885-4670
uality 885-5065
truction Grants 885-5870

STATE OF NEVADA

Groundwater 702/885-4670
Waste Management 885-4670
Water Pollution 885-4670

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
201 South Fall Street
Carson City, Nevada 89710

August 10, 1988

Everett Robertson
National Park Service
Lake Mead National Recreation Area
601 Nevada Highway
Boulder City, NV 89005

Dear Mr. Robertson:

In accordance with provisions of the Federal Water Pollution Control Act (33 U.S.C. 1251, et. seq.) and the Nevada Water Pollution Control Law Chapter 445, of the Nevada Revised Statutes, the Department of Conservation and Natural Resources, Division of Environmental Protection has reviewed the following application for a permit to discharge:

Discharger	Permit Numbers
National Park Service	NEV50011
National Park Service	NEV50013
National Park Service	NEV50014
National Park Service	NEV50016

This office published a public notice of our proposed action in the June 23, 1988 edition of the Boulder City News and Las Vegas Sun. The notice was also sent to interested persons on our mailing list.

After consideration of all comments received during the 30 day comment period, the Division of Environmental Protection is issuing the enclosed permit to National Park Service. This action does not constitute a significant change from the tentative determinations set forth in the public notice.

Enclosed for your use are the following:

1. Discharge Monitoring Report (DMR) forms which must be used for submitting data to this office at the address listed in the permit. Copies of this form can be made and used to report on a quarterly basis as required. The next Discharge Monitoring Report is due on October 28, 1988 and quarterly thereafter.

The permit shall take effect on August 8, 1988. If you have any questions on this matter, feel free to contact me at 885-4670.

Sincerely,

Albert F Porta

Albert F. Porta
Permits Officer

AP/srs
Enclosure
cc: F. James Gans, CCSD, w/encl.

(0)-4837

Permit No. NEV50013

AUTHORIZATION TO DISCHARGE

In compliance with the provisions of the Federal Water Pollution Control Act as amended, (33 U.S.C. 1251 et. seg; the "Act"), and the Nevada Revised Statutes,

National Park Service
Lake Mead National Recreation Area
601 Nevada Highway
Boulder City, NV 89005

is authorized to discharge from a facility located at

Cottonwood Cove
Lake Mead National Recreation Area
Latitude: 35° 29'
Longitude: 114° 42'
T28S,R65E, Sec 26

to receiving waters named

groundwater of the State of Nevada
via an evaporation/percolation basin.

in accordance with effluent limitations, monitoring requirements, and other conditions set forth in Part I, II and III hereof.

This permit shall become effective on 8 August 88.

This permit and the authorization to discharge shall expire at midnight, 8 August 1993.

Signed this 8th day of August, 1988.

Albert F Porta
Albert F. Porta
Permits Officer

A. EFFLUENT LIMITATIONS, MONITORING REQUIREMENTS AND CONDITIONS

1. During the period beginning on the effective date of this permit, and lasting until the permit expires, the the permittee is authorized to discharge from the treatment facility to groundwater of the State of Nevada via an evaporation/percolation basin.

   Samples taken in compliance with the monitoring requirements specified below shall be taken at the following locations(s): Influent lift station.

   The discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS						MONITORING REQUIREMENTS	
	30-day Average			Daily Max.			Measurement Frequency	Sample Type
	mg/l	Kg/day	lbs./day	mg/l	Kg/day	lbs./day		
Flow [1]		0.033 MGD			---		Continuous	Composite
BOD_5 [2]	---	---	---	---	---	---	Quarterly	Composite
TSS [2]	---	---	---	---	---	---	Quarterly	Composite

1. Influent flow shall be measured by way of pump timers.

2. Influent shall be sampled.

2. The treatment works shall not cause objectionable odors in the collection system, treatment facility or disposal site.

3. There shall be no discharge of substances that would cause a viol tion of water quality standards of the State of Nevada.

4. All solid waste shall be disposed pursuant to approval of the Division.

5. There shall be no discharge from the collection, treatment and disposal facilities except as authorized by this permit.

6. The treatment and disposal facility shall be fenced and posted.

7. The collection, treatment and disposal facilities shall be constructed in conformance with plans approved by the Division. Any change to the approved plans must be sent immediately to the Division for approval.

8. An Operations and Maintenance Manual shall be submitted to this Division within 90 days of permit issuance. The facility shall b operated in accordance with the Operations and Maintenance Manual which must be approved by the Division.

9. Staff gauges must be installed in the ponds within 90 days of permit issuance at a location representative of a liquid level.

10. The site shall be inspected a minimum of once a week by the opera tor and a reading of the staff gauge taken. A log detailing the name of the inspector, date, time and the results of the inspection including the staff gauge reading at least to the nearest tenth of a foot must be included with the quarterly Discharge Monitoring Report.

11. If the Division determines through its design review and/or inspection that groundwater monitoring is necessary, the permitte shall establish a monitoring well or wells in locations approved by the Division. The design and location of the wells shall be reviewed and approved by the Division prior to installation. The monitoring well(s) shall be sampled quarterly for Total phosphate (as P), Nitrates (as N), and Chlorides and submitted in accordanc with Part I.C.2. of this permit.

12. Sewage collection lines that service facilities on the lake must be located out of the lake so that they can be inspected. On an annual basis, collection lines must be inspected for leaks, deterioration and contact with Lake Mead water. An annual report must be submitted to this Division to assure this Division that there is no discharge or will be no discharge to Lake Mead via these collection lines. Collection lines which serve facilities on the Lake will be considered part of this treatment works.

13. High water and low pressure (discharge line) alarms must be installed at all lift stations within 180 days of permit issuance

Part I (continued)

B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations upon issuance of the permit.

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

3. The Director, may upon request of the permittee and after public notice, revise or modify a schedule of compliance in an issued permit if he determines good and valid cause (strike, flood, materials shortage or other event over which the permittee has little or no control) exists for such revision.

C. MONITORING AND REPORTING

1. Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Reporting

   Monitoring results obtained during the previous three (3) months shall be summarized for each month and reported on a Discharge Monitoring Report Form postmarked no later than the 28th day of the month following the completed reporting period. The first report is due on 28 Oct 88. Duplicated signed copies of these, and all other reports required herein, shall be submitted to the State and the Regional Administrator at the following addresses:

   Division of Environmental Protection
   Water Pollution Control
   201 South Fall Street, Room 221
   Capitol Complex
   Carson City, NV 89710

3. Definitions

   a. The "30-day average discharge" means the total discharge during a month divided by the number of days in the period that the facility was discharging. Where less than daily sampling is required by this permit, the 30-day average discharge shall be determined by the summation of all the measured discharges divided by the number of days during the period when the measurements were made.

Part I.C.3. (continued)

If fewer than four measurements are made during a month, then compliance or noncompliance with the 30-day average discharge limitations shall not be determined.

b. The "daily maximum" discharge means the total discharge during any calendar day.

c. The "30-day average concentration", other than for fecal coliform bacteria, means the arithmetic mean of measurements made during a month. The "30-day average concentration" for fecal coliform bacteria means the geometric mean of measurements made during a month. The geometric mean is the nth root of the product of n numbers.

If fewer than four measurements are made during a month, the compliance or noncompliance with the 30-day average concentration limitation shall not be determined.

d. The "daily maximum" concentration means the measurement made on any single discrete sample or composite sample.

e. A "discrete" sample means any individual sample collected in less than 15 minutes.

f. A "composite" sample means, for flow rate measurements, the arithmetic mean of no fewer than four (4) individual measurements taken at equal time intervals for eight (8) hours, or for the duration of discharge, whichever is shorter. A "composite" sample means, for other than flow rate measurements, a combination of no fewer than four (4) individual samples obtained at equal time intervals for either (8) hours, or for the duration of discharge, whichever is shorter. The volume of each individual sample shall be proportional to the discharge flow rate at the time of sampling.

4. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations (40 CFR, Part 136) published pursuant to Section 304(h) of the Act, under which such procedures may be required unless other procedures are approved by the Division.

Part I.C. (continued)

5. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. the exact place, date, and time of sampling;
b. the dates the analyses were performed;
c. the person(s) who performed the analyses;
d. the analytical techniques or methods used; and
e. the results of all required analyses.

6. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form. Such increased frequency shall also be indicated.

7. Records Retention

All records and information resulting from the monitoring activities required by this permit, including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation, shall be retained for a minimum of three (3) years, or longer if required by the Director.

8. Modification of Monitoring Frequency and Sample Type

After considering monitoring data, stream flow, discharge flow and receiving water conditions, the Division of Environmental Protection may, for just cause, modify the monitoring frequency and/or sample type by issuing an order to the permittee.

9. Permit Modification and Reissuance

This permit may be modified, or alternatively, revoked and reissued, to comply with any applicable effluent limitation issued pursuant to the order of the United States District Court for the District of Columbia issued on June 8, 1976, in Natural Resources Defense Council, Inc. et al. v Russell E. Train, 8 ERC 2120 (D.D.C. 1976), if the effluent limitations so issued:

a. is different in conditions or more stringent than any effluent limitations in the permit; or

b. controls any pollutant not limited in the permit.

PART II

A. MANAGEMENT REQUIREMENTS

1. Change in Discharge

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions, or treatment modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Any changes to the permitted treatment facility must comply with Nevada Administrative Code (NAC) 445.179 to 445.181. Pursuant to NAC 445.174, the permit may be modified to specify and limit any pollutants not previously limited.

2. Facilities Operation

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities, collection systems or pump stations installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

3. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to receiving waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Noncompliance, Unauthorized Discharge, Bypassing and Upset

   a. Any diversion, bypass, spill, overflow or discharge of treated or untreated wastewater from facilities described in Part II.A.2 of this permit is prohibited except as authorized by this permit. I the event the permittee has knowledge that a diversion, bypass, spill, overflow or discharge not authorized by this permit is probable, the permittee shall notify the Division of Environmenta Protection immediately.

   b. The permittee shall notify the Division of Environmental Protection within twenty-four (24) hours of any diversion, bypass, spill, upset, overflow or discharge of treated or untreated sewag other than that which is authorized by the permit. A written

Part II.A. (continued)

report shall be submitted to the Director within five (5) days of diversion, bypass, spill, overflow, upset or discharge, detailing the entire incident including:

(1) time and date of discharge;
(2) exact location and estimated amount of discharge;
(3) flow path and any bodies of water which the discharge reached;
(4) the specific cause of the discharge; and
(5) the preventive and/or corrective actions taken.

c. The following shall be included as information which must be reported orally within 24 hours: any unanticipated bypass which exceeds any effluent limitation in the permit; any upset which exceeds any effluent limitation in the permit; and violation of a limitation for any toxic pollutant or any pollutant identified as the method to control a toxic pollutant.

d. The permittee shall report all instances of noncompliance not reported under Part II.A.4.b. at the time monitoring reports are submitted. The reports shall contain the information listed in Part II.A.4.b.

e. An "upset means an exceptional incident in which there is unintentional and temporary noncompliance with the permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

f. In selecting the appropriate enforcement option, the Division of Environmental Protection shall consider whether or not the noncompliance was the result of an upset.

g. The burden of proof is on the permittee to establish that an upset occurred.

In order to establish that an upset occurred, the permittee must provide, in addition to the information required under paragraph II.A.4.b. above, properly signed contemporaneous logs or other documentary evidence that:

(1) The facility was at the time being properly operated as required in paragraph II.A.2 above; and

(2) All reasonable steps were taken to minimize adverse impacts as required by paragraph II.A.3 above.

Part II.A. (continued)

5. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of waste waters shall be disposed of in a manner such as to prevent any pollution from such materials from entering any navigable waters.

6. Safeguards to Electric Power Failure

In order to maintain compliance with the effluent limitations and prohibitions of this permit the permittee shall either:

a. provide at the time of discharge an alternative power source sufficient to operate the wastewater control facilities;

or, if such alternative power is not in existence,

b. halt or reduce all discharges upon the reduction, loss, or failure of the primary source of power to the waste water control facilities.

B. RESPONSIBILITIES

1. Right of Entry

The permittee shall allow the Director and/or his authorized representatives, upon the presentation of credentials:

a. to enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b. at reasonable times, to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to perform any necessary sampling to determine compliance with this permit or to sample any discharge.

2. Transfer of Ownership or Control

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the permittee shall notify the succeeding owner or controller of the existence of this permit, by letter, a copy of which shall be forwarded to the Director. All transfer of permits shall be approved by the Division of Environmental Protection.

Part II.B. (continued)

3. Availability of Reports

Except for data determined to be confidential under NRS 445.311, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the office of the State. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in NRS 445.337.

4. Furnishing False Information and Tampering with Monitoring Devices

Any person who knowingly makes any false statement, representation, or certification in any application, record, report, plan or other document filed or required to be maintained by the provisions of NRS 445.131 to 445.354, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, or who falsifies, tampers with or knowingly renders inaccurate any monitoring device or method required to be maintained under the provisions of NRS 445.131 to 445.354, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, is guilty of a gross misdemeanor and shall be punished by a fine of not more than $10,000 or by imprisonment in the county jail for not more than 1 year, or by both fine and imprisonment. This penalty is in addition to any other penalties, civil or criminal, provided pursuant to NRS 445.131 to 445.354, inclusive.

5. Penalty for Violation of Permit Conditions

Nevada Revised Statutes (NRS) 445.317 provides that any person who violates a permit condition is subject to administrative and judicial sanctions as outlined in NRS 445.324 through 445.334.

6. Permit Modification, Suspension or Revocation

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. violation of any terms or conditions of this permit;

b. obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. a change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

Part II.B. (continued)

7. Toxic Pollutants

Notwithstanding Part II.B.6 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard in prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

8. Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable Federal, State or local laws, regulations, or ordinances.

9. Property Rights

The issuance of this permit does not convey any property rights, in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provisions of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

PART III

A. OTHER REQUIREMENTS

1. Reapplication

If the permittee desires to continue to discharge, he shall reapply not later than 180 days before this permit expires on the application forms then in use.

2. Signatory Requirements

a. Applications. All permit applications shall be signed as follows:

(1) For a corporation: by a responsible corporate officer. For the purposes of this section, a responsible corporate officer means (a) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (b) the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

(2) For a partnership or sole proprietorship: by a general partner or proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected offical. For purposes of this section, a principal executive officer of a Federal agency includes (a) the chief executive officer of the agency, or (b) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

b. Reports. All reports required by permits and and other information requested by the Director shall be signed by a person described in paragraph a. of this section, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described in paragraph a. of this section;

Part III.A.2.b. (continued)

(2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plan manager, operator of a well or a well field, superintendent, or position of equivalent responsibility. (A duly authorize representative may thus be either a named individual or any individual occupying a named position.); and

(3) The written authorization is submitted to the Division.

c. Changes to authorization. If an authorization under paragraph b. of this section is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph b. of this section must be submitted to the Division prior to or together with any reports, information, or applications to be signed by an authorized representative.

d. Certification. Any person signing a document under paragraphs a. or b. of this section shall make the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

3. Holding Pond Conditions

If any wastewater from the permittee's facility is placed in ponds, such ponds shall be located and constructed so as to:

a. contain with no discharge the once-in-one-hundred year storm at said location;

b. withstand with no discharge the once-in-one-hundred year flood of said location; and

c. prevent escape of wastewater by leakage other than as authorized by this permit.

Part III.A. (continued)

4. Flow Rate Notification

The permittee shall notify the Director, by letter, not later than ninety (90) days after the 30-day average daily influent flow rate first equals or exceeds 85% of the design treatment capacity of the permittee's facility given in Part I.A. above. The letter shall include:

a. The 30-day average daily influent flow rate;

b. The maximum 24 hour flow rate during the 30 day period reported above and the date the maximum flow occurred.

c. The permittee's estimate of when the 30-day average influent flow rate will equal or exceed the design treatment capacity of the permittee's facility; and

d. the permittee's schedule of compliance to provide additional treatment capacity before the 30-day average daily influent flow rate equals the present design treatment capacity of the permittee's facility.

The permittee shall implement and comply with the provisions of the schedule of compliance after approval by the Director, including in said implementation and compliance, any additions or modifications which the Director may make in approving the schedule of compliance.

Permit No. NEV50014

AUTHORIZATION TO DISCHARGE

In compliance with the provisions of the Federal Water Pollution Control Ac as amended, (33 U.S.C. 1251 et. seg; the "Act"), and the Nevada Revised Statutes,

National Park Service
Lake Mead National Recreation Area
601 Nevada Highway
Boulder City, NV 89005

is authorized to discharge from a facility located at

Echo Bay
Lake Mead National Recreation Area

Latitude: 36° 20'
Longitude: 114° 27'
T18S, R67E, Sec 36.

to receiving waters named

groundwater of the State of Nevada
via evaporation/percolation basin.

in accordance with effluent limitations, monitoring requirements, and other conditions set forth in Part I, II and III hereof.

This permit shall become effective on 8 August 88.

This permit and the authorization to discharge shall expire at midnight, 8 August 93.

Signed this 8th day of August, 1988.

Albert F Porta
Albert F. Porta
Permits Officer

A. EFFLUENT LIMITATIONS, MONITORING REQUIREMENTS AND CONDITIONS

1. During the period beginning on the effective date of this permit, and lasting until the permit expires, the the permittee is authorized to discharge from the treatment facility to groundwater of the State of Nevada via an evaporation/percolation basin.

   Samples taken in compliance with the monitoring requirements specified below shall be taken at the following locations(s): Influent lift station.

   The discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS						MONITORING REQUIREMENTS	
	30-day Average			Daily Max.			Measurement Frequency	Sample Type
	mg/l	Kg/day	lbs./day	mg/l	Kg/day	lbs./day		
Flow[1]	0.082 MGD				---		Continuous	Composite
BOD_5 [2]	---	---	---	---	---	---	Quarterly	Composite
Total Suspended Solids[2]	---	---	---	---	---	---	Quarterly	Composite

---

[1]. Influent flow shall be measured by way of pump timers. The influent flow will be limited to 0.036 MGD until a total of 6 horsepower aerators are installed. Aerators must be permanently installed within 180 days of permit issuance.

[2]. Influent shall be sampled.

2. The treatment works shall not cause objectionable odors in the collection system, treatment facility or disposal site.

3. There shall be no discharge of substances that would cause a violation of water quality standards of the State of Nevada.

4. All solid waste shall be disposed pursuant to approval of the Division.

5. There shall be no discharge from the collection, treatment and disposal facilities except as authorized by this permit.

6. The treatment and disposal facility shall be fenced and posted.

7. The collection, treatment and disposal facilities shall be constructed in conformance with plans approved by the Division. Any change to the approved plans must be sent immediately to the Division for approval.

8. An Operations and Maintenance Manual shall be submitted to this Division within 90 days of permit issuance. The facility shall be operated in accordance with the Operations and Maintenance Manual which must be approved by the Division.

9. Staff gauges must be installed in the ponds within 90 days of permit issuance at a location representative of a liquid level.

10. The site shall be inspected a minimum of once a week by the operator and a reading of the staff gauge taken. A log detailing the name of the inspector, date, time and the results of the inspection including the staff gauge reading at least to the nearest tenth of a foot must be included with the quarterly Discharge Monitoring Report.

11. If the Division determines through its design review and/or inspection that groundwater monitoring is necessary, the permittee shall establish a monitoring well or wells in locations approved by the Division. The design and location of the wells shall be reviewed and approved by the Division prior to installation. The monitoring well(s) shall be sampled quarterly for Total phosphate (as P), Nitrates (as N), and Chlorides and submitted in accordance with Part I.C.2. of this permit.

12. Sewage collection lines that service facilities on the lake must be located out of the lake so that they can be inspected. On an annual basis, collection lines must be inspected for leaks, deterioration and contact with Lake Mead water. An annual report must be submitted to this Division to assure this Division that there is no discharge or will be no discharge to Lake Mead via these collection lines. Collection lines which serve facilities on the Lake will be considered part of this treatment works.

13. High water and low pressure (discharge line) alarms must be installed at all lift stations within 180 days of permit issuance.

Part I (continued)

B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations upon issuance of the permit.

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

3. The Director, may upon request of the permittee and after public notice, revise or modify a schedule of compliance in an issued permit if he determines good and valid cause (strike, flood, materials shortage or other event over which the permittee has little or no control) exists for such revision.

C. MONITORING AND REPORTING

1. Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Reporting

Monitoring results obtained during the previous three (3) months shall be summarized for each month and reported on a Discharge Monitoring Report Form postmarked no later than the 28th day of the month following the completed reporting period. The first report is due on 28OcT88. Duplicated signed copies of these, and all other reports required herein, shall be submitted to the State and the Regional Administrator at the following addresses:

Division of Environmental Protection
Water Pollution Control
201 South Fall Street, Room 221
Capitol Complex
Carson City, NV 89710

3. Definitions

   a. The "30-day average discharge" means the total discharge during a month divided by the number of days in the period that the facility was discharging. Where less than daily sampling is required by this permit, the 30-day average discharge shall be determined by the summation of all the measured discharges divided by the number of days during the period when the measurements were made.

Part I.C.3. (continued)

If fewer than four measurements are made during a month, then compliance or noncompliance with the 30-day average discharge limitations shall not be determined.

b. The "daily maximum" discharge means the total discharge during a calendar day.

c. The "30-day average concentration", other than for fecal colifor bacteria, means the arithmetic mean of measurements made during month. The "30-day average concentration" for fecal coliform ba teria means the geometric mean of measurements made during a month. The geometric mean is the nth root of the product of n numbers.

If fewer than four measurements are made during a month, the compliance or noncompliance with the 30-day average concentratio limitation shall not be determined.

d. The "daily maximum" concentration means the measurement made on any single discrete sample or composite sample.

e. A "discrete" sample means any individual sample collected in les than 15 minutes.

f. A "composite" sample means, for flow rate measurements, the arit metic mean of no fewer than four (4) individual measurements tak at equal time intervals for eight (8) hours, or for the duration of discharge, whichever is shorter. A "composite" sample means, for other than flow rate measurements, a combination of no fewer than four (4) individual samples obtained at equal time interval for either (8) hours, or for the duration of discharge, whicheve is shorter. The volume of each individual sample shall be propo tional to the discharge flow rate at the time of sampling.

4. Test Procedures

Test procedures for the analysis of pollutants shall conform to regul tions (40 CFR, Part 136) published pursuant to Section 304(h) of the Act, under which such procedures may be required unless other procedures are approved by the Division.

Part I.C. (continued)

5. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. the exact place, date, and time of sampling;
b. the dates the analyses were performed;
c. the person(s) who performed the analyses;
d. the analytical techniques or methods used; and
e. the results of all required analyses.

6. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form. Such increased frequency shall also be indicated.

7. Records Retention

All records and information resulting from the monitoring activities required by this permit, including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation, shall be retained for a minimum of three (3) years, or longer if required by the Director.

8. Modification of Monitoring Frequency and Sample Type

After considering monitoring data, stream flow, discharge flow and receiving water conditions, the Division of Environmental Protection may, for just cause, modify the monitoring frequency and/or sample type by issuing an order to the permittee.

9. Permit Modification and Reissuance

This permit may be modified, or alternatively, revoked and reissued, to comply with any applicable effluent limitation issued pursuant to the order of the United States District Court for the District of Columbia issued on June 8, 1976, in Natural Resources Defense Council, Inc. et al. v Russell E. Train, 8 ERC 2120 (D.D.C. 1976), if the effluent limitations so issued:

a. is different in conditions or more stringent than any effluent limitations in the permit; or

b. controls any pollutant not limited in the permit.

PART II

A. MANAGEMENT REQUIREMENTS

1. Change in Discharge

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions, or treatment modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Any changes to the permitted treatment facility must comply with Nevada Administrative Code (NAC) 445.179 to 445.181. Pursuant to NAC 445.174, the permit may be modified to specify and limit any pollutants not previously limited.

2. Facilities Operation

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities, collection systems or pump stations installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

3. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to receiving waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Noncompliance, Unauthorized Discharge, Bypassing and Upset

   a. Any diversion, bypass, spill, overflow or discharge of treated or untreated wastewater from facilities described in Part II.A.2 of this permit is prohibited except as authorized by this permit. In the event the permittee has knowledge that a diversion, bypass, spill, overflow or discharge not authorized by this permit is probable, the permittee shall notify the Division of Environmental Protection immediately.

   b. The permittee shall notify the Division of Environmental Protection within twenty-four (24) hours of any diversion, bypass, spill, upset, overflow or discharge of treated or untreated sewage other than that which is authorized by the permit. A written

Part II.A. (continued)

report shall be submitted to the Director within five (5) days of diversion, bypass, spill, overflow, upset or discharge, detailing the entire incident including:

(1) time and date of discharge;
(2) exact location and estimated amount of discharge;
(3) flow path and any bodies of water which the discharge reached;
(4) the specific cause of the discharge; and
(5) the preventive and/or corrective actions taken.

c. The following shall be included as information which must be reported orally within 24 hours: any unanticipated bypass which exceeds any effluent limitation in the permit; any upset which exceeds any effluent limitation in the permit; and violation of a limitation for any toxic pollutant or any pollutant identified as the method to control a toxic pollutant.

d. The permittee shall report all instances of noncompliance not reported under Part II.A.4.b. at the time monitoring reports are submitted. The reports shall contain the information listed in Part II.A.4.b.

e. An "upset means an exceptional incident in which there is unintentional and temporary noncompliance with the permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

f. In selecting the appropriate enforcement option, the Division of Environmental Protection shall consider whether or not the noncompliance was the result of an upset.

g. The burden of proof is on the permittee to establish that an upset occurred.

In order to establish that an upset occurred, the permittee must provide, in addition to the information required under paragraph II.A.4.b. above, properly signed contemporaneous logs or other documentary evidence that:

(1) The facility was at the time being properly operated as required in paragraph II.A.2 above; and

(2) All reasonable steps were taken to minimize adverse impacts as required by paragraph II.A.3 above.

Part II.A. (continued)

5. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of waste waters shall be disposed of in a manner such as to prevent any pollution from such materials from entering any navigable waters.

6. Safeguards to Electric Power Failure

In order to maintain compliance with the effluent limitations and prohibitions of this permit the permittee shall either:

a. provide at the time of discharge an alternative power source sufficient to operate the wastewater control facilities;

or, if such alternative power is not in existence,

b. halt or reduce all discharges upon the reduction, loss, or failure of the primary source of power to the waste water control facilities.

B. RESPONSIBILITIES

1. Right of Entry

The permittee shall allow the Director and/or his authorized representatives, upon the presentation of credentials:

a. to enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b. at reasonable times, to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to perform any necessary sampling to determine compliance with this permit or to sample any discharge.

2. Transfer of Ownership or Control

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the permittee shall notify the succeeding owner or controller of the existence of this permit, by letter, a copy of which shall be forwarded to the Director. All transfer of permits shall be approved by the Division of Environmental Protection.

Part II.B. (continued)

3. Availability of Reports

Except for data determined to be confidential under NRS 445.311, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the office of the State. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in NRS 445.337.

4. Furnishing False Information and Tampering with Monitoring Devices

Any person who knowingly makes any false statement, representation, or certification in any application, record, report, plan or other document filed or required to be maintained by the provisions of NRS 445.131 to 445.354, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, or who falsifies, tampers with or knowingly renders inaccurate any monitoring device or method required to be maintained under the provisions of NRS 445.131 to 445.354, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, is guilty of a gross misdemeanor and shall be punished by a fine of not more than $10,000 or by imprisonment in the county jail for not more than 1 year, or by both fine and imprisonment. This penalty is in addition to any other penalties, civil or criminal, provided pursuant to NRS 445.131 to 445.354, inclusive.

5. Penalty for Violation of Permit Conditions

Nevada Revised Statutes (NRS) 445.317 provides that any person who violates a permit condition is subject to administrative and judicial sanctions as outlined in NRS 445.324 through 445.334.

6. Permit Modification, Suspension or Revocation

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. violation of any terms or conditions of this permit;

b. obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. a change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

Part II.B. (continued)

7. Toxic Pollutants

Notwithstanding Part II.B.6 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard in prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modifie in accordance with the toxic effluent standard or prohibition and the permittee so notified.

8. Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities liabilities, or penalties established pursuant to any applicable Federal, State or local laws, regulations, or ordinances.

9. Property Rights

The issuance of this permit does not convey any property rights, in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provisions of this permit to an circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

PART III

A. OTHER REQUIREMENTS

1. Reapplication

If the permittee desires to continue to discharge, he shall reapply not later than 180 days before this permit expires on the application forms then in use.

2. Signatory Requirements

a. Applications. All permit applications shall be signed as follows:

(1) For a corporation: by a responsible corporate officer. For the purposes of this section, a responsible corporate officer means (a) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (b) the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

(2) For a partnership or sole proprietorship: by a general partner or proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected offical. For purposes of this section, a principal executive officer of a Federal agency includes (a) the chief executive officer of the agency, or (b) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

b. Reports. All reports required by permits and and other information requested by the Director shall be signed by a person described in paragraph a. of this section, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described in paragraph a. of this section;

Part III.A.2.b. (continued)

(2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, or position of equivalent responsibility. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and

(3) The written authorization is submitted to the Division.

c. Changes to authorization. If an authorization under paragraph b. of this section is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph b. of this section must be submitted to the Division prior to or together with any reports, information, or applications to be signed by an authorized representative.

d. Certification. Any person signing a document under paragraphs a. or b. of this section shall make the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

3. Holding Pond Conditions

If any wastewater from the permittee's facility is placed in ponds, such ponds shall be located and constructed so as to:

a. contain with no discharge the once-in-one-hundred year storm at said location;

b. withstand with no discharge the once-in-one-hundred year flood of said location; and

c. prevent escape of wastewater by leakage other than as authorized by this permit.

Part III.A. (continued)

4. Flow Rate Notification

The permittee shall notify the Director, by letter, not later than ninety (90) days after the 30-day average daily influent flow rate first equals or exceeds 85% of the design treatment capacity of the permittee's facility given in Part I.A. above. The letter shall include:

a. The 30-day average daily influent flow rate;

b. The maximum 24 hour flow rate during the 30 day period reported above and the date the maximum flow occurred.

c. The permittee's estimate of when the 30-day average influent flow rate will equal or exceed the design treatment capacity of the permittee's facility; and

d. the permittee's schedule of compliance to provide additional treatment capacity before the 30-day average daily influent flow rate equals the present design treatment capacity of the permittee's facility.

The permittee shall implement and comply with the provisions of the schedule of compliance after approval by the Director, including in said implementation and compliance, any additions or modifications which the Director may make in approving the schedule of compliance.

Permit No. NEV50011

AUTHORIZATION TO DISCHARGE

In compliance with the provisions of the Federal Water Pollution Control A as amended, (33 U.S.C. 1251 et. seg; the "Act"), and the Nevada Revised Statutes,

National Park Service
Lake Mead National Recreation Area
601 Nevada Highway
Boulder City, NV 89005

is authorized to discharge from a facility located at

Boulder Beach
Latitude: 36° 02'
Longitude: 114° 50'
T22S, R64E Sec 9 & 10

to receiving waters named

groundwater of the State of Nevada
via evaporation/percolation basins

in accordance with effluent limitations, monitoring requirements, and other co ditions set forth in Part I, II and III hereof.

This permit shall become effective on 8 August 88.

This permit and the authorization to discharge shall expire at midnight, 8 August 93.

Signed this 8th day of August, 1988.

Albert F. Porta
Permits Officer

A. EFFLUENT LIMITATIONS, MONITORING REQUIREMENTS AND CONDITIONS

1. During the period beginning on the effective date of this permit, and lasting until the permit expires, the the permittee is authorized to discharge from the treatment facility to groundwater of the State of Nevada via evaporation/percolation basins.

Samples taken in compliance with the monitoring requirements specified below shall be taken at the following locations(s): Influent lift station.

The discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS						MONITORING REQUIREMENTS	
	30-day Average			Daily Max.			Measurement Frequency	Sample Type
	mg/l	Kg/day	lbs./day	mg/l	Kg/day	lbs./day		
Flow [1]		0.064 MGD			---		Continuous	Composite
BOD$_5$ [2]	---	---	---	---	---	---	Quarterly	Composite
Total Suspended Solids [2]	---	---	---	---	---	---	Quarterly	Composite

1. Influent flow shall be measured by way of pump timers.
2. Influent shall be sampled.

2. The treatment works shall not cause objectionable odors in the collection system, treatment facility or disposal site.

3. There shall be no discharge of substances that would cause a vio tion of water quality standards of the State of Nevada.

4. All solid waste shall be disposed pursuant to approval of the Division.

5. There shall be no discharge from the collection, treatment and disposal facilities except as authorized by this permit.

6. The treatment and disposal facility shall be fenced and posted.

7. The collection, treatment and disposal facilities shall be constructed in conformance with plans approved by the Division. Any change to the approved plans must be sent immediately to the Division for approval.

8. An Operations and Maintenance Manual shall be submitted to this Division within 90 days of permit issuance. The facility shall operated in accordance with the Operations and Maintenance Manua which must be approved by the Division.

9. Staff gauges must be installed in the ponds within 90 days of pe mit issuance at a location representative of a liquid level.

10. The site shall be inspected a minimum of once a week by the oper tor and a reading of the staff gauge taken. A log detailing the name of the inspector, date, time and the results of the inspection including the staff gauge reading at least to the nearest tenth of a foot must be included with the quarterly Discharge Monitoring Report.

11. If the Division determines through its design review and/or inspection that groundwater monitoring is necessary, the permitt shall establish a monitoring well or wells in locations approved by the Division. The design and location of the wells shall be reviewed and approved by the Division prior to installation. Th monitoring well(s) shall be sampled quarterly for Total phosphat (as P), Nitrates (as N), and Chlorides and submitted in accordan with Part I.C.2. of this permit.

12. Sewage collection lines that service facilities on the lake must be located out of the lake so that they can be inspected. On an annual basis, collection lines must be inspected for leaks, deterioration and conta~~n~~ct, with Lake Mead water. An annual repo must be submitted to this Division to assure this Division that there is no discharge or will be no discharge to Lake Mead via these collection lines. Collection lines which serve facilities on the Lake will be considered part of this treatment works.

13. High water and low pressure (discharge line) alarms must be installed at all lift stations within six months of the permit issuance.

Part I (continued)

B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations upon issuance of the permit.

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

3. The Director, may upon request of the permittee and after public notice, revise or modify a schedule of compliance in an issued permit if he determines good and valid cause (strike, flood, materials shortage or other event over which the permittee has little or no control) exists for such revision.

C. MONITORING AND REPORTING

1. Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Reporting

Monitoring results obtained during the previous three (3) months shall be summarized for each month and reported on a Discharge Monitoring Report Form postmarked no later than the 28th day of the month following the completed reporting period. The first report is due on 28Oct88 . Duplicated signed copies of these, and all other reports required herein, shall be submitted to the State and the Regional Administrator at the following addresses:

Division of Environmental Protection
Water Pollution Control
201 South Fall Street, Room 221
Capitol Complex
Carson City, NV 89710

3. Definitions

a. The "30-day average discharge" means the total discharge during a month divided by the number of days in the period that the facility was discharging. Where less than daily sampling is required by this permit, the 30-day average discharge shall be determined by the summation of all the measured discharges divided by the number of days during the period when the measurements were made.

Part I.C.3. (continued)

If fewer than four measurements are made during a month, then compliance or noncompliance with the 30-day average discharge limitations shall not be determined.

b. The "daily maximum" discharge means the total discharge during any calendar day.

c. The "30-day average concentration", other than for fecal coliform bacteria, means the arithmetic mean of measurements made during a month. The "30-day average concentration" for fecal coliform bacteria means the geometric mean of measurements made during a month. The geometric mean is the nth root of the product of n numbers.

If fewer than four measurements are made during a month, the compliance or noncompliance with the 30-day average concentration limitation shall not be determined.

d. The "daily maximum" concentration means the measurement made on any single discrete sample or composite sample.

e. A "discrete" sample means any individual sample collected in less than 15 minutes.

f. A "composite" sample means, for flow rate measurements, the arithmetic mean of no fewer than four (4) individual measurements taken at equal time intervals for eight (8) hours, or for the duration of discharge, whichever is shorter. A "composite" sample means, for other than flow rate measurements, a combination of no fewer than four (4) individual samples obtained at equal time intervals for either (8) hours, or for the duration of discharge, whichever is shorter. The volume of each individual sample shall be proportional to the discharge flow rate at the time of sampling.

4. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations (40 CFR, Part 136) published pursuant to Section 304(h) of the Act, under which such procedures may be required unless other procedures are approved by the Division.

Part I.C. (continued)

5. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. the exact place, date, and time of sampling;
b. the dates the analyses were performed;
c. the person(s) who performed the analyses;
d. the analytical techniques or methods used; and
e. the results of all required analyses.

6. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form. Such increased frequency shall also be indicated.

7. Records Retention

All records and information resulting from the monitoring activities required by this permit, including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation, shall be retained for a minimum of three (3) years, or longer if required by the Director.

8. Modification of Monitoring Frequency and Sample Type

After considering monitoring data, stream flow, discharge flow and receiving water conditions, the Division of Environmental Protection may, for just cause, modify the monitoring frequency and/or sample type by issuing an order to the permittee.

9. Permit Modification and Reissuance

This permit may be modified, or alternatively, revoked and reissued, to comply with any applicable effluent limitation issued pursuant to the order of the United States District Court for the District of Columbia issued on June 8, 1976, in Natural Resources Defense Council, Inc. et al. v Russell E. Train, 8 ERC 2120 (D.D.C. 1976), if the effluent limitations so issued:

a. is different in conditions or more stringent than any effluent limitations in the permit; or

b. controls any pollutant not limited in the permit.

PART II

A. MANAGEMENT REQUIREMENTS

1. Change in Discharge

All discharges authorized herein shall be consistent with the terms an conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipate facility expansions, or treatment modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new application or, if such changes will not violat the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Any changes to the permitte treatment facility must comply with Nevada Administrative Code (NAC) 445.179 to 445.181. Pursuant to NAC 445.174, the permit may be modified to specify and limit any pollutants not previously limited.

2. Facilities Operation

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities collection systems or pump stations installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

3. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to receiving waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Noncompliance, Unauthorized Discharge, Bypassing and Upset

a. Any diversion, bypass, spill, overflow or discharge of treated or untreated wastewater from facilities described in Part II.A.2 of this permit is prohibited except as authorized by this permit. I the event the permittee has knowledge that a diversion, bypass, spill, overflow or discharge not authorized by this permit is probable, the permittee shall notify the Division of Environmenta Protection immediately.

b. The permittee shall notify the Division of Environmental Protection within twenty-four (24) hours of any diversion, bypass, spill, upset, overflow or discharge of treated or untreated sewag other than that which is authorized by the permit. A written

Part II.A. (continued)

report shall be submitted to the Director within five (5) days of diversion, bypass, spill, overflow, upset or discharge, detailing the entire incident including:

(1) time and date of discharge;
(2) exact location and estimated amount of discharge;
(3) flow path and any bodies of water which the discharge reached;
(4) the specific cause of the discharge; and
(5) the preventive and/or corrective actions taken.

c. The following shall be included as information which must be reported orally within 24 hours: any unanticipated bypass which exceeds any effluent limitation in the permit; any upset which exceeds any effluent limitation in the permit; and violation of a limitation for any toxic pollutant or any pollutant identified as the method to control a toxic pollutant.

d. The permittee shall report all instances of noncompliance not reported under Part II.A.4.b. at the time monitoring reports are submitted. The reports shall contain the information listed in Part II.A.4.b.

e. An "upset means an exceptional incident in which there is unintentional and temporary noncompliance with the permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

f. In selecting the appropriate enforcement option, the Division of Environmental Protection shall consider whether or not the noncompliance was the result of an upset.

g. The burden of proof is on the permittee to establish that an upset occurred.

In order to establish that an upset occurred, the permittee must provide, in addition to the information required under paragraph II.A.4.b. above, properly signed contemporaneous logs or other documentary evidence that:

(1) The facility was at the time being properly operated as required in paragraph II.A.2 above; and

(2) All reasonable steps were taken to minimize adverse impacts as required by paragraph II.A.3 above.

Part II.A. (continued)

5. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of waste waters shall be disposed of i a manner such as to prevent any pollution from such materials from entering any navigable waters.

6. Safeguards to Electric Power Failure

In order to maintain compliance with the effluent limitations and prohibitions of this permit the permittee shall either:

a. provide at the time of discharge an alternative power source sufficient to operate the wastewater control facilities;

or, if such alternative power is not in existence,

b. halt or reduce all discharges upon the reduction, loss, or failu of the primary source of power to the waste water control facilities.

B. RESPONSIBILITIES

1. Right of Entry

The permittee shall allow the Director and/or his authorized representatives, upon the presentation of credentials:

a. to enter upon the permittee's premises where an effluent source i located or in which any records are required to be kept under the terms and conditions of this permit; and

b. at reasonable times, to have access to and copy any records required to be kept under the terms and conditions of this permit to inspect any monitoring equipment or monitoring method required in this permit; and to perform any necessary sampling to determin compliance with this permit or to sample any discharge.

2. Transfer of Ownership or Control

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the permittee shall notify the succeeding owner or controller of the existence of this permit, by letter, a copy of which shall be forwarded to the Director. All transfer of permits shall be approved by the Division of Environmental Protection.

Part II.B. (continued)

3. Availability of Reports

Except for data determined to be confidential under NRS 445.311, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the office of the State. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in NRS 445.337.

4. Furnishing False Information and Tampering with Monitoring Devices

Any person who knowingly makes any false statement, representation, or certification in any application, record, report, plan or other document filed or required to be maintained by the provisions of NRS 445.131 to 445.354, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, or who falsifies, tampers with or knowingly renders inaccurate any monitoring device or method required to be maintained under the provisions of NRS 445.131 to 445.354, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, is guilty of a gross misdemeanor and shall be punished by a fine of not more than $10,000 or by imprisonment in the county jail for not more than 1 year, or by both fine and imprisonment. This penalty is in addition to any other penalties, civil or criminal, provided pursuant to NRS 445.131 to 445.354, inclusive.

5. Penalty for Violation of Permit Conditions

Nevada Revised Statutes (NRS) 445.317 provides that any person who violates a permit condition is subject to administrative and judicial sanctions as outlined in NRS 445.324 through 445.334.

6. Permit Modification, Suspension or Revocation

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. violation of any terms or conditions of this permit;

b. obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. a change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

Part II.B. (continued)

7. Toxic Pollutants

Notwithstanding Part II.B.6 above, if a toxic effluent standard or pro hibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard in prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modifie in accordance with the toxic effluent standard or prohibition and the permittee so notified.

8. Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities liabilities, or penalties established pursuant to any applicable Federal, State or local laws, regulations, or ordinances.

9. Property Rights

The issuance of this permit does not convey any property rights, in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provisions of this permit to a circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

PART III

A. OTHER REQUIREMENTS

1. Reapplication

If the permittee desires to continue to discharge, he shall reapply not later than 180 days before this permit expires on the application forms then in use.

2. Signatory Requirements

a. Applications. All permit applications shall be signed as follows:

(1) For a corporation: by a responsible corporate officer. For the purposes of this section, a responsible corporate officer means (a) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (b) the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

(2) For a partnership or sole proprietorship: by a general partner or proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected offical. For purposes of this section, a principal executive officer of a Federal agency includes (a) the chief executive officer of the agency, or (b) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

b. Reports. All reports required by permits and and other information requested by the Director shall be signed by a person described in paragraph a. of this section, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described in paragraph a. of this section;

Part III.A.2.b. (continued)

(2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plan manager, operator of a well or a well field, superintendent, or position of equivalent responsibility. (A duly authorize representative may thus be either a named individual or any individual occupying a named position.); and

(3) The written authorization is submitted to the Division.

c. Changes to authorization. If an authorization under paragraph b. of this section is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph b. of this section must be submitted to the Division prior to or together with any reports, information, or applications to be signed by an authorized representative.

d. Certification. Any person signing a document under paragraphs a. or b. of this section shall make the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

3. Holding Pond Conditions

If any wastewater from the permittee's facility is placed in ponds, such ponds shall be located and constructed so as to:

a. contain with no discharge the once-in-one-hundred year storm at said location;

b. withstand with no discharge the once-in-one-hundred year flood of said location; and

c. prevent escape of wastewater by leakage other than as authorized by this permit.

Part III.A. (continued)

4. Flow Rate Notification

The permittee shall notify the Director, by letter, not later than ninety (90) days after the 30-day average daily influent flow rate first equals or exceeds 85% of the design treatment capacity of the permittee's facility given in Part I.A. above. The letter shall include:

a. The 30-day average daily influent flow rate;

b. The maximum 24 hour flow rate during the 30 day period reported above and the date the maximum flow occurred.

c. The permittee's estimate of when the 30-day average influent flow rate will equal or exceed the design treatment capacity of the permittee's facility; and

d. the permittee's schedule of compliance to provide additional treatment capacity before the 30-day average daily influent flow rate equals the present design treatment capacity of the permittee's facility.

The permittee shall implement and comply with the provisions of the schedule of compliance after approval by the Director, including in said implementation and compliance, any additions or modifications which the Director may make in approving the schedule of compliance.

Permit No. NEV50016

AUTHORIZATION TO DISCHARGE

In compliance with the provisions of the Federal Water Pollution Control Ac as amended, (33 U.S.C. 1251 et. seg; the "Act"), and the Nevada Revised Statutes,

National Park Service
Lake Mead National Recreation Area
601 Nevada Highway
Boulder City, NV 89005

is authorized to discharge from a facility located at

Overton Beach
Latitude: 36° 26'
Longitude: 114° 23'
T17S, R68E Sec 22

to receiving waters named

groundwater of the State of Nevada
via evaporation/percolation basins

in accordance with effluent limitations, monitoring requirements, and other conditions set forth in Part I, II and III hereof.

This permit shall become effective on 8 August 88.

This permit and the authorization to discharge shall expire at midnight, 8 August 1993.

Signed this 8th day of August, 1988.

Albert F Porta

Albert F. Porta
Permits Officer

Part I

A. EFFLUENT LIMITATIONS, MONITORING REQUIREMENTS AND CONDITIONS

1. During the period beginning on the effective date of this permit, and lasting until the permit expires, the the permittee is authorized to discharge from the treatment facility to groundwater of the State of Nevada via evaporation/percolation basins.

   Samples taken in compliance with the monitoring requirements specified below shall be taken at the following locations(s): Influent lift station.

   The discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS						MONITORING REQUIREMENTS	
	30-day Average			Daily Max.			Measurement Frequency	Sample Type
	mg/l	Kg/day	lbs./day	mg/l	Kg/day	lbs./day		
Flow [1]		0.038 MGD			---		Continuous	Composite
BOD$_5$ [2]	---	---	---	---	---	---	Quarterly	Composite
Total Suspended Solids [2]	---	---	---	---	---	---	Quarterly	Composite

1. Influent flow shall be measured by way of pump timers.
2. Influent shall be sampled.

2. The treatment works shall not cause objectionable odors in the collection system, treatment facility or disposal site.

3. There shall be no discharge of substances that would cause a violation of water quality standards of the State of Nevada.

4. All solid waste shall be disposed pursuant to approval of the Division.

5. There shall be no discharge from the collection, treatment and disposal facilities except as authorized by this permit.

6. The treatment and disposal facility shall be fenced and posted.

7. The collection, treatment and disposal facilities shall be constructed in conformance with plans approved by the Division. Any change to the approved plans must be sent immediately to the Division for approval.

8. An Operations and Maintenance Manual shall be submitted to this Division within 90 days of permit issuance. The facility shall be operated in accordance with the Operations and Maintenance Manual which must be approved by the Division.

9. Staff gauges must be installed in the ponds within 90 days of permit issuance at a location representative of a liquid level.

10. The site shall be inspected a minimum of once a week by the operator and a reading of the staff gage taken. A log detailing the name of the inspector, date, time and the results of the inspection including the staff gage reading at least to the nearest tenth of a foot must be included with the quarterly Discharge Monitoring Report.

11. If the Division determines through its design review and/or inspections that groundwater monitoring is necessary, the permitte shall establish a monitoring well or wells in locations approved by the Division. The design and location of the wells shall be reviewed and approved by the Division prior to installation. The monitoring well(s) shall be sampled quarterly for Total phosphate (as P), Nitrates (as N), and Chlorides and submitted in accordanc with Part I.C.2. of this permit.

12. Sewage collection lines that service facilities on the lake must be located out of the lake so that they can be inspected. On an annual basis, collection lines must be inspected for leaks, deterioration and contact, with Lake Mead water. An annual report must be submitted to this Division to assure this Division that there is no discharge or will be no discharge to Lake Mead via these collection lines. Collection lines which serve facilties o the Lake will be considered part of this treatment works.

13. High water and low pressure (discharge line) alarms must be installed at all lift stations within 180 days of permit issuance.

Part I (continued)

B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations upon issuance of the permit.

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

3. The Director, may upon request of the permittee and after public notice, revise or modify a schedule of compliance in an issued permit if he determines good and valid cause (strike, flood, materials shortage or other event over which the permittee has little or no control) exists for such revision.

C. MONITORING AND REPORTING

1. Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Reporting

Monitoring results obtained during the previous three (3) months shall be summarized for each month and reported on a Discharge Monitoring Report Form postmarked no later than the 28th day of the month following the completed reporting period. The first report is due on 28 Oct 88. Duplicated signed copies of these, and all other reports required herein, shall be submitted to the State and the Regional Administrator at the following addresses:

Division of Environmental Protection
Water Pollution Control
201 South Fall Street, Room 221
Capitol Complex
Carson City, NV 89710

3. Definitions

   a. The "30-day average discharge" means the total discharge during a month divided by the number of days in the period that the facility was discharging. Where less than daily sampling is required by this permit, the 30-day average discharge shall be determined by the summation of all the measured discharges divided by the number of days during the period when the measurements were made.

Part I.C.3. (continued)

If fewer than four measurements are made during a month, then compliance or noncompliance with the 30-day average discharge limitations shall not be determined.

b. The "daily maximum" discharge means the total discharge during an calendar day.

c. The "30-day average concentration", other than for fecal coliform bacteria, means the arithmetic mean of measurements made during a month. The "30-day average concentration" for fecal coliform bacteria means the geometric mean of measurements made during a month. The geometric mean is the nth root of the product of n numbers.

If fewer than four measurements are made during a month, the compliance or noncompliance with the 30-day average concentration limitation shall not be determined.

d. The "daily maximum" concentration means the measurement made on any single discrete sample or composite sample.

e. A "discrete" sample means any individual sample collected in less than 15 minutes.

f. A "composite" sample means, for flow rate measurements, the arithmetic mean of no fewer than four (4) individual measurements take at equal time intervals for eight (8) hours, or for the duration of discharge, whichever is shorter. A "composite" sample means, for other than flow rate measurements, a combination of no fewer than four (4) individual samples obtained at equal time intervals for either (8) hours, or for the duration of discharge, whichever is shorter. The volume of each individual sample shall be proportional to the discharge flow rate at the time of sampling.

4. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations (40 CFR, Part 136) published pursuant to Section 304(h) of the Act, under which such procedures may be required unless other procedures are approved by the Division.

Part I.C. (continued)

5. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. the exact place, date, and time of sampling;
b. the dates the analyses were performed;
c. the person(s) who performed the analyses;
d. the analytical techniques or methods used; and
e. the results of all required analyses.

6. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form. Such increased frequency shall also be indicated.

7. Records Retention

All records and information resulting from the monitoring activities required by this permit, including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation, shall be retained for a minimum of three (3) years, or longer if required by the Director.

8. Modification of Monitoring Frequency and Sample Type

After considering monitoring data, stream flow, discharge flow and receiving water conditions, the Division of Environmental Protection may, for just cause, modify the monitoring frequency and/or sample type by issuing an order to the permittee.

9. Permit Modification and Reissuance

This permit may be modified, or alternatively, revoked and reissued, to comply with any applicable effluent limitation issued pursuant to the order of the United States District Court for the District of Columbia issued on June 8, 1976, in Natural Resources Defense Council, Inc. et al. v Russell E. Train, 8 ERC 2120 (D.D.C. 1976), if the effluent limitations so issued:

a. is different in conditions or more stringent than any effluent limitations in the permit; or

b. controls any pollutant not limited in the permit.

PART II

A. MANAGEMENT REQUIREMENTS

1. Change in Discharge

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions, or treatment modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Any changes to the permitted treatment facility must comply with Nevada Administrative Code (NAC) 445.179 to 445.181. Pursuant to NAC 445.174, the permit may be modified to specify and limit any pollutants not previously limited.

2. Facilities Operation

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities, collection systems or pump stations installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

3. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to receiving waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Noncompliance, Unauthorized Discharge, Bypassing and Upset

a. Any diversion, bypass, spill, overflow or discharge of treated or untreated wastewater from facilities described in Part II.A.2 of this permit is prohibited except as authorized by this permit. In the event the permittee has knowledge that a diversion, bypass, spill, overflow or discharge not authorized by this permit is probable, the permittee shall notify the Division of Environmental Protection immediately.

b. The permittee shall notify the Division of Environmental Protection within twenty-four (24) hours of any diversion, bypass, spill, upset, overflow or discharge of treated or untreated sewage other than that which is authorized by the permit. A written

Part II.A. (continued)

report shall be submitted to the Director within five (5) days of diversion, bypass, spill, overflow, upset or discharge, detailing the entire incident including:

(1) time and date of discharge;
(2) exact location and estimated amount of discharge;
(3) flow path and any bodies of water which the discharge reached;
(4) the specific cause of the discharge; and
(5) the preventive and/or corrective actions taken.

c. The following shall be included as information which must be reported orally within 24 hours: any unanticipated bypass which exceeds any effluent limitation in the permit; any upset which exceeds any effluent limitation in the permit; and violation of a limitation for any toxic pollutant or any pollutant identified as the method to control a toxic pollutant.

d. The permittee shall report all instances of noncompliance not reported under Part II.A.4.b. at the time monitoring reports are submitted. The reports shall contain the information listed in Part II.A.4.b.

e. An "upset means an exceptional incident in which there is unintentional and temporary noncompliance with the permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

f. In selecting the appropriate enforcement option, the Division of Environmental Protection shall consider whether or not the noncompliance was the result of an upset.

g. The burden of proof is on the permittee to establish that an upset occurred.

In order to establish that an upset occurred, the permittee must provide, in addition to the information required under paragraph II.A.4.b. above, properly signed contemporaneous logs or other documentary evidence that:

(1) The facility was at the time being properly operated as required in paragraph II.A.2 above; and

(2) All reasonable steps were taken to minimize adverse impacts as required by paragraph II.A.3 above.

Part II.A. (continued)

5. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of waste waters shall be disposed of in a manner such as to prevent any pollution from such materials from entering any navigable waters.

6. Safeguards to Electric Power Failure

In order to maintain compliance with the effluent limitations and prohibitions of this permit the permittee shall either:

a. provide at the time of discharge an alternative power source sufficient to operate the wastewater control facilities;

or, if such alternative power is not in existence,

b. halt or reduce all discharges upon the reduction, loss, or failure of the primary source of power to the waste water control facilities.

B. RESPONSIBILITIES

1. Right of Entry

The permittee shall allow the Director and/or his authorized representatives, upon the presentation of credentials:

a. to enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b. at reasonable times, to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to perform any necessary sampling to determine compliance with this permit or to sample any discharge.

2. Transfer of Ownership or Control

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the permittee shall notify the succeeding owner or controller of the existence of this permit, by letter, a copy of which shall be forwarded to the Director. All transfer of permits shall be approved by the Division of Environmental Protection.

Part II.B. (continued)

3. Availability of Reports

Except for data determined to be confidential under NRS 445.311, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the office of the State. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in NRS 445.337.

4. Furnishing False Information and Tampering with Monitoring Devices

Any person who knowingly makes any false statement, representation, or certification in any application, record, report, plan or other document filed or required to be maintained by the provisions of NRS 445.131 to 445.354, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, or who falsifies, tampers with or knowingly renders inaccurate any monitoring device or method required to be maintained under the provisions of NRS 445.131 to 445.354, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, is guilty of a gross misdemeanor and shall be punished by a fine of not more than $10,000 or by imprisonment in the county jail for not more than 1 year, or by both fine and imprisonment. This penalty is in addition to any other penalties, civil or criminal, provided pursuant to NRS 445.131 to 445.354, inclusive.

5. Penalty for Violation of Permit Conditions

Nevada Revised Statutes (NRS) 445.317 provides that any person who violates a permit condition is subject to administrative and judicial sanctions as outlined in NRS 445.324 through 445.334.

6. Permit Modification, Suspension or Revocation

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. violation of any terms or conditions of this permit;

b. obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. a change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

Part II.B. (continued)

7. Toxic Pollutants

Notwithstanding Part II.B.6 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard in prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

8. Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable Federal, State or local laws, regulations, or ordinances.

9. Property Rights

The issuance of this permit does not convey any property rights, in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provisions of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

PART III

A. OTHER REQUIREMENTS

1. Reapplication

If the permittee desires to continue to discharge, he shall reapply not later than 180 days before this permit expires on the application forms then in use.

2. Signatory Requirements

a. Applications. All permit applications shall be signed as follows:

(1) For a corporation: by a responsible corporate officer. For the purposes of this section, a responsible corporate officer means (a) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (b) the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

(2) For a partnership or sole proprietorship: by a general partner or proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected offical. For purposes of this section, a principal executive officer of a Federal agency includes (a) the chief executive officer of the agency, or (b) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

b. Reports. All reports required by permits and and other information requested by the Director shall be signed by a person described in paragraph a. of this section, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described in paragraph a. of this section;

Part III.A.2.b. (continued)

(2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, or position of equivalent responsibility. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and

(3) The written authorization is submitted to the Division.

c. Changes to authorization. If an authorization under paragraph b. of this section is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph b. of this section must be submitted to the Division prior to or together with any reports, information, or applications to be signed by an authorized representative.

d. Certification. Any person signing a document under paragraphs a. or b. of this section shall make the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

3. Holding Pond Conditions

If any wastewater from the permittee's facility is placed in ponds, such ponds shall be located and constructed so as to:

a. contain with no discharge the once-in-one-hundred year storm at said location;

b. withstand with no discharge the once-in-one-hundred year flood of said location; and

c. prevent escape of wastewater by leakage other than as authorized by this permit.

Part III.A. (continued)

4. Flow Rate Notification

The permittee shall notify the Director, by letter, not later than ninety (90) days after the 30-day average daily influent flow rate first equals or exceeds 85% of the design treatment capacity of the permittee's facility given in Part I.A. above. The letter shall include:

a. The 30-day average daily influent flow rate;

b. The maximum 24 hour flow rate during the 30 day period reported above and the date the maximum flow occurred.

c. The permittee's estimate of when the 30-day average influent flow rate will equal or exceed the design treatment capacity of the permittee's facility; and

d. the permittee's schedule of compliance to provide additional treatment capacity before the 30-day average daily influent flow rate equals the present design treatment capacity of the permittee's facility.

The permittee shall implement and comply with the provisions of the schedule of compliance after approval by the Director, including in said implementation and compliance, any additions or modifications which the Director may make in approving the schedule of compliance.

Permit No. NEV50012

AUTHORIZATION TO DISCHARGE

In compliance with the provisions of the Federal Water Pollution Control Act as amended, (33 U.S.C. 1251 et. seq; the "Act"), and the Nevada Revised Statutes,

National Park Service
Lake Mead National Recreation Area
601 Nevada Highway
Boulder City, NV 89005

is authorized to discharge from a facility located at

Callville Bay
Lake Mead National Recreation Area
Latitude: 36° 10'
Longitude: 114° 43'
T20S, R65E

to receiving waters named

groundwater of the State of Nevada via an evaporation/percolation basin

in accordance with effluent limitations, monitoring requirements, and other conditions set forth in Part I, II and III hereof.

This permit shall become effective on 21 December 88.

This permit and the authorization to discharge shall expire at midnight, 21 December 1993.

Signed this 21st day of December, 1988.

Albert F. Porta
Permits Officer

A. EFFLUENT LIMITATIONS, MONITORING REQUIREMENTS AND CONDITIONS

1. During the period beginning on the effective date of this permit, and lasting until the permit expires, the the permittee is authorized to discharge from the treatment facility to groundwater of the State of Nevada via an evaporation/percolation basin.

   Samples taken in compliance with the monitoring requirements specified below shall be taken at the following locations(s): Influent lift station.

   The discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS						MONITORING REQUIREMENTS	
	30-day Average			Daily Max.			Measurement Frequency	Sample Type
	mg/l	Kg/day	lbs./day	mg/l	Kg/day	lbs./day		
Flow[1]		0.069 MGD			---		Continuous	Composite
BOD_5 [2]	---	---	---	---	---	---	Quarterly	Composite
TSS[2]	---	---	---	---	---	---	Quarterly	Composite

---

1. Influent flow shall be measured by way of pump timers.

2. Influent shall be sampled.

2. The treatment works shall not cause objectionable odors in the collection system, treatment facility or disposal site.

3. There shall be no discharge of substances that would cause a vio tion of water quality standards of the State of Nevada.

4. All solid waste shall be disposed pursuant to approval of the Division.

5. There shall be no discharge from the collection, treatment and disposal facilities except as authorized by this permit.

6. The treatment and disposal facility shall be fenced and posted.

7. The collection, treatment and disposal facilities shall be constructed in conformance with plans approved by the Division. Any change to the approved plans must be sent immediately to the Division for approval.

8. An Operations and Maintenance Manual shall be submitted to this Division within 90 days of permit issuance. The facility shall b operated in accordance with the Operations and Maintenance Manual which must be approved by the Division.

9. Staff gauges must be installed in the ponds within 90 days of permit issuance at a location representative of a liquid level.

10. The site shall be inspected a minimum of once a week by the operator and a reading of the staff gauge taken. A log detailing the name of the inspector, date, time and the results of the inspection including the staff gauge reading at least to the nearest tenth of a foot must be included with the quarterly Discharge Monitoring Report.

11. If the Division determines through its design review and/or inspection that groundwater monitoring is necessary, the permitte shall establish a monitoring well or wells in locations approved by the Division. The design and location of the wells shall be reviewed and approved by the Division prior to installation. The monitoring well(s) shall be sampled quarterly for Total phosphate (as P), Nitrates (as N), and Chlorides and submitted in accordance with Part I.C.2. of this permit.

12. Any sewage collection lines that service facilities on the lake mu be located out of the lake so that they can be inspected. On an annual basis, collection lines must be inspected for leaks, deterioration and contact with Lake Mead water. An annual report must be submitted to this Division to assure this Division that there is no discharge or will be no discharge to Lake Mead via these collection lines. Collection lines which serve facilities on the Lake will be considered part of this treatment works.

13. High water and low pressure (discharge line) alarms must be installed at all lift stations within 180 days of permit issuance.

B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations upon issuance of the permit.

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

3. The Director, may upon request of the permittee and after public notice, revise or modify a schedule of compliance in an issued permit if he determines good and valid cause (strike, flood, materials shortage or other event over which the permittee has little or no control) exists for such revision.

4. Preliminary plans and specifications to upgrade this facility to 0.0885 MGD in accordance with adopted design criteria, must be submitted to this Division for review and approval by September 30, 1988. In addition, the existing, facility must be properly fenced and posted by September 30, 1989.

5. Final plans and specifications must be submitted for review and approval by September 30, 1990.

6. Construction in accordance with approved plans and specifications must be completed by September 30, 1991.

C. MONITORING AND REPORTING

1. Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Reporting

Monitoring results obtained during the previous three (3) months shall be summarized for each month and reported on a Discharge Monitoring Report Form postmarked no later than the 28th day of the month following the completed reporting period. The first report is due on 28 Jan 89 . Duplicated signed copies of these, and all other reports required herein, shall be submitted to the State and the Regional Administrator at the following addresses:

Division of Environmental Protection
Water Pollution Control
201 South Fall Street, Room 221
Capitol Complex
Carson City, NV 89710

3. Definitions

   a. The "30-day average discharge" means the total discharge during a month divided by the number of days in the period that the facility was discharging. Where less than daily sampling is required by this permit, the 30-day average discharge shall be determined by the summation of all the measured discharges divided by the number of days during the period when the measurements were made.

Part I.C.3. (continued)

If fewer than four measurements are made during a month, then compliance or noncompliance with the 30-day average discharge limitations shall not be determined.

b. The "daily maximum" discharge means the total discharge during a calendar day.

c. The "30-day average concentration", other than for fecal coliform bacteria, means the arithmetic mean of measurements made during a month. The "30-day average concentration" for fecal coliform bacteria means the geometric mean of measurements made during a month. The geometric mean is the nth root of the product of n numbers.

If fewer than four measurements are made during a month, the compliance or noncompliance with the 30-day average concentration limitation shall not be determined.

d. The "daily maximum" concentration means the measurement made on any single discrete sample or composite sample.

e. A "discrete" sample means any individual sample collected in less than 15 minutes.

f. A "composite" sample means, for flow rate measurements, the arithmetic mean of no fewer than four (4) individual measurements take at equal time intervals for eight (8) hours, or for the duration of discharge, whichever is shorter. A "composite" sample means, for other than flow rate measurements, a combination of no fewer than four (4) individual samples obtained at equal time intervals for either (8) hours, or for the duration of discharge, whichever is shorter. The volume of each individual sample shall be proportional to the discharge flow rate at the time of sampling.

4. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations (40 CFR, Part 136) published pursuant to Section 304(h) of the Act, under which such procedures may be required unless other procedures are approved by the Division.

Part I.C. (continued)

5. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. the exact place, date, and time of sampling;
b. the dates the analyses were performed;
c. the person(s) who performed the analyses;
d. the analytical techniques or methods used; and
e. the results of all required analyses.

6. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form. Such increased frequency shall also be indicated.

7. Records Retention

All records and information resulting from the monitoring activities required by this permit, including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation, shall be retained for a minimum of three (3) years, or longer if required by the Director.

8. Modification of Monitoring Frequency and Sample Type

After considering monitoring data, stream flow, discharge flow and receiving water conditions, the Division of Environmental Protection may, for just cause, modify the monitoring frequency and/or sample type by issuing an order to the permittee.

9. Permit Modification and Reissuance

This permit may be modified, or alternatively, revoked and reissued, to comply with any applicable effluent limitation issued pursuant to the order of the United States District Court for the District of Columbia issued on June 8, 1976, in *Natural Resources Defense Council, Inc. et al. v Russell E. Train, 8 ERC 2120 (D.D.C. 1976), if the effluent limitations so issued:*

a. is different in conditions or more stringent than any effluent limitations in the permit; or

b. controls any pollutant not limited in the permit.

PART II

A. MANAGEMENT REQUIREMENTS

1. Change in Discharge

All discharges authorized herein shall be consistent with the terms a conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipat facility expansions, or treatment modifications which will result in new, different, or increased discharges of pollutants must be reporte by submission of a new application or, if such changes will not viola the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Any changes to the permitt treatment facility must comply with Nevada Administrative Code (NAC) 445.179 to 445.181. Pursuant to NAC 445.174, the permit may be modified to specify and limit any pollutants not previously limited.

2. Facilities Operation

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control faciliti collection systems or pump stations installed or used by the permitte to achieve compliance with the terms and conditions of this permit.

3. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to receiving waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Noncompliance, Unauthorized Discharge, Bypassing and Upset

a. Any diversion, bypass, spill, overflow or discharge of treated o untreated wastewater from facilities described in Part II.A.2 of this permit is prohibited except as authorized by this permit. I the event the permittee has knowledge that a diversion, bypass, spill, overflow or discharge not authorized by this permit is probable, the permittee shall notify the Division of Environmenta Protection immediately.

b. The permittee shall notify the Division of Environmental Protection within twenty-four (24) hours of any diversion, bypass, spill, upset, overflow or discharge of treated or untreated sewag other than that which is authorized by the permit. A written

Part II.A. (continued)

report shall be submitted to the Director within five (5) days of diversion, bypass, spill, overflow, upset or discharge, detailing the entire incident including:

(1) time and date of discharge;
(2) exact location and estimated amount of discharge;
(3) flow path and any bodies of water which the discharge reached;
(4) the specific cause of the discharge; and
(5) the preventive and/or corrective actions taken.

c. The following shall be included as information which must be reported orally within 24 hours: any unanticipated bypass which exceeds any effluent limitation in the permit; any upset which exceeds any effluent limitation in the permit; and violation of a limitation for any toxic pollutant or any pollutant identified as the method to control a toxic pollutant.

d. The permittee shall report all instances of noncompliance not reported under Part II.A.4.b. at the time monitoring reports are submitted. The reports shall contain the information listed in Part II.A.4.b.

e. An "upset means an exceptional incident in which there is unintentional and temporary noncompliance with the permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

f. In selecting the appropriate enforcement option, the Division of Environmental Protection shall consider whether or not the noncompliance was the result of an upset.

g. The burden of proof is on the permittee to establish that an upset occurred.

In order to establish that an upset occurred, the permittee must provide, in addition to the information required under paragraph II.A.4.b. above, properly signed contemporaneous logs or other documentary evidence that:

(1) The facility was at the time being properly operated as required in paragraph II.A.2 above; and

(2) All reasonable steps were taken to minimize adverse impacts as required by paragraph II.A.3 above.

Part II.A. (continued)

5. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of waste waters shall be disposed of i a manner such as to prevent any pollution from such materials from entering any navigable waters.

6. Safeguards to Electric Power Failure

In order to maintain compliance with the effluent limitations and prohibitions of this permit the permittee shall either:

a. provide at the time of discharge an alternative power source sufficient to operate the wastewater control facilities;

or, if such alternative power is not in existence,

b. halt or reduce all discharges upon the reduction, loss, or failu of the primary source of power to the waste water control facilities.

B. RESPONSIBILITIES

1. Right of Entry

The permittee shall allow the Director and/or his authorized representatives, upon the presentation of credentials:

a. to enter upon the permittee's premises where an effluent source i located or in which any records are required to be kept under the terms and conditions of this permit; and

b. at reasonable times, to have access to and copy any records required to be kept under the terms and conditions of this permit to inspect any monitoring equipment or monitoring method required in this permit; and to perform any necessary sampling to determin compliance with this permit or to sample any discharge.

2. Transfer of Ownership or Control

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the permittee shall notify the succeeding owner or controller of the existence of this permit, by letter, a copy of which shall be forwarded to the Director. All transfer of permits shall be approved by the Division of Environmental Protection.

Part II.B. (continued)

3. Availability of Reports

Except for data determined to be confidential under NRS 445.311, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the office of the State. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in NRS 445.337.

4. Furnishing False Information and Tampering with Monitoring Devices

Any person who knowingly makes any false statement, representation, or certification in any application, record, report, plan or other document filed or required to be maintained by the provisions of NRS 445.131 to 445.354, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, or who falsifies, tampers with or knowingly renders inaccurate any monitoring device or method required to be maintained under the provisions of NRS 445.131 to 445.354, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, is guilty of a gross misdemeanor and shall be punished by a fine of not more than $10,000 or by imprisonment in the county jail for not more than 1 year, or by both fine and imprisonment. This penalty is in addition to any other penalties, civil or criminal, provided pursuant to NRS 445.131 to 445.354, inclusive.

5. Penalty for Violation of Permit Conditions

Nevada Revised Statutes (NRS) 445.317 provides that any person who violates a permit condition is subject to administrative and judicial sanctions as outlined in NRS 445.324 through 445.334.

6. Permit Modification, Suspension or Revocation

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. violation of any terms or conditions of this permit;

b. obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. a change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

Part II.B. (continued)

7. Toxic Pollutants

Notwithstanding Part II.B.6 above, if a toxic effluent standard or pr hibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge an such standard in prohibition is more stringent than any limitation fo such pollutant in this permit, this permit shall be revised or modifi in accordance with the toxic effluent standard or prohibition and the permittee so notified.

8. Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities liabilities, or penalties established pursuant to any applicable Federal, State or local laws, regulations, or ordinances.

9. Property Rights

The issuance of this permit does not convey any property rights, in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provisions of this permit to an circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

PART III

A. OTHER REQUIREMENTS

1. Reapplication

If the permittee desires to continue to discharge, he shall reapply not later than 180 days before this permit expires on the application forms then in use.

2. Signatory Requirements

a. Applications. All permit applications shall be signed as follows:

(1) For a corporation: by a responsible corporate officer. For the purposes of this section, a responsible corporate officer means (a) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (b) the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

(2) For a partnership or sole proprietorship: by a general partner or proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected offical. For purposes of this section, a principal executive officer of a Federal agency includes (a) the chief executive officer of the agency, or (b) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

b. Reports. All reports required by permits and and other information requested by the Director shall be signed by a person described in paragraph a. of this section, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described in paragraph a. of this section;

Part III.A.2.b. (continued)

(2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of pla manager, operator of a well or a well field, superintendent or position of equivalent responsibility. (A duly authoriz representative may thus be either a named individual or any individual occupying a named position.); and

(3) The written authorization is submitted to the Division.

c. Changes to authorization. If an authorization under paragraph b of this section is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph b. of this section must be submitted to the Division prior to or together with any reports, information, or applications to be signed by an authorized representative.

d. Certification. Any person signing a document under paragraphs a. or b. of this section shall make the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

3. Holding Pond Conditions

If any wastewater from the permittee's facility is placed in ponds, such ponds shall be located and constructed so as to:

a. contain with no discharge the once-in-one-hundred year storm at said location;

b. withstand with no discharge the once-in-one-hundred year flood of said location; and

c. prevent escape of wastewater by leakage other than as authorized by this permit.

Part III.A. (continued)

4. Flow Rate Notification

The permittee shall notify the Director, by letter, not later than ninety (90) days after the 30-day average daily influent flow rate first equals or exceeds 85% of the design treatment capacity of the permittee's facility given in Part I.A. above. The letter shall include:

a. The 30-day average daily influent flow rate;

b. The maximum 24 hour flow rate during the 30 day period reported above and the date the maximum flow occurred.

c. The permittee's estimate of when the 30-day average influent flow rate will equal or exceed the design treatment capacity of the permittee's facility; and

d. the permittee's schedule of compliance to provide additional treatment capacity before the 30-day average daily influent flow rate equals the present design treatment capacity of the permittee's facility.

The permittee shall implement and comply with the provisions of the schedule of compliance after approval by the Director, including in said implementation and compliance, any additions or modifications which the Director may make in approving the schedule of compliance.

Permit No. NEV50013

AUTHORIZATION TO DISCHARGE

In compliance with the provisions of the Federal Water Pollution Control Act as amended, (33 U.S.C. 1251 et. seg; the "Act"), and the Nevada Revised Statutes,

National Park Service
Lake Mead National Recreation Area
601 Nevada Highway
Boulder City, NV 89005

is authorized to discharge from a facility located at

Cottonwood Cove
Lake Mead National Recreation Area
Latitude: 35° 29'
Longitude: 114° 42'
T28S,R65E, Sec 26

to receiving waters named

groundwater of the State of Nevada
via an evaporation/percolation basin.

in accordance with effluent limitations, monitoring requirements, and other conditions set forth in Part I, II and III hereof.

This permit shall become effective on 8 August 88.

This permit and the authorization to discharge shall expire at midnight, 8 August 1993.

Signed this 8th day of August, 1988.

Albert F Porta

Albert F. Porta
Permits Officer

A. EFFLUENT LIMITATIONS, MONITORING REQUIREMENTS AND CONDITIONS

1. During the period beginning on the effective date of this permit, and lasting until the permit expires, the permittee is authorized to discharge from the treatment facility to groundwater of the State of Nevada via an evaporation/percolation basin.

Samples taken in compliance with the monitoring requirements specified below shall be taken at the following locations(s): Influent lift station.

The discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS						MONITORING REQUIREMENTS	
	30-day Average			Daily Max.			Measurement Frequency	Sample Type
	mg/l	Kg/day	lbs./day	mg/l	Kg/day	lbs./day		
Flow [1]		0.033 MGD			---		Continuous	Composite
BOD$_5$ [2]	---	---	---	---	---	---	Quarterly	Composite
TSS [2]	---	---	---	---	---	---	Quarterly	Composite

---

1. Influent flow shall be measured by way of pump timers.

2. Influent shall be sampled.

2. The treatment works shall not cause objectionable odors in the collection system, treatment facility or disposal site.

3. There shall be no discharge of substances that would cause a violation of water quality standards of the State of Nevada.

4. All solid waste shall be disposed pursuant to approval of the Division.

5. There shall be no discharge from the collection, treatment and disposal facilities except as authorized by this permit.

6. The treatment and disposal facility shall be fenced and posted.

7. The collection, treatment and disposal facilities shall be constructed in conformance with plans approved by the Division. Any change to the approved plans must be sent immediately to the Division for approval.

8. An Operations and Maintenance Manual shall be submitted to this Division within 90 days of permit issuance. The facility shall be operated in accordance with the Operations and Maintenance Manual which must be approved by the Division.

9. Staff gauges must be installed in the ponds within 90 days of permit issuance at a location representative of a liquid level.

10. The site shall be inspected a minimum of once a week by the operator and a reading of the staff gauge taken. A log detailing the name of the inspector, date, time and the results of the inspection including the staff gauge reading at least to the nearest tenth of a foot must be included with the quarterly Discharge Monitoring Report.

11. If the Division determines through its design review and/or inspection that groundwater monitoring is necessary, the permittee shall establish a monitoring well or wells in locations approved by the Division. The design and location of the wells shall be reviewed and approved by the Division prior to installation. The monitoring well(s) shall be sampled quarterly for Total phosphate (as P), Nitrates (as N), and Chlorides and submitted in accordance with Part I.C.2. of this permit.

12. Sewage collection lines that service facilities on the lake must be located out of the lake so that they can be inspected. On an annual basis, collection lines must be inspected for leaks, deterioration and contact with Lake Mead water. An annual report must be submitted to this Division to assure this Division that there is no discharge or will be no discharge to Lake Mead via these collection lines. Collection lines which serve facilities on the Lake will be considered part of this treatment works.

13. High water and low pressure (discharge line) alarms must be installed at all lift stations within 180 days of permit issuance.

Part I (continued)

B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations upon issuance of the permit.

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

3. The Director, may upon request of the permittee and after public notice, revise or modify a schedule of compliance in an issued permit if he determines good and valid cause (strike, flood, materials shortage or other event over which the permittee has little or no control) exists for such revision.

C. MONITORING AND REPORTING

1. Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Reporting

   Monitoring results obtained during the previous three (3) months shall be summarized for each month and reported on a Discharge Monitoring Report Form postmarked no later than the 28th day of the month following the completed reporting period. The first report is due on 28 Oct 88. Duplicated signed copies of these, and all other reports required herein, shall be submitted to the State and the Regional Administrator at the following addresses:

   Division of Environmental Protection
   Water Pollution Control
   201 South Fall Street, Room 221
   Capitol Complex
   Carson City, NV 89710

3. Definitions

   a. The "30-day average discharge" means the total discharge during a month divided by the number of days in the period that the facility was discharging. Where less than daily sampling is required by this permit, the 30-day average discharge shall be determined by the summation of all the measured discharges divided by the number of days during the period when the measurements were made.

Part I.C.3. (continued)

If fewer than four measurements are made during a month, then compliance or noncompliance with the 30-day average discharge limitations shall not be determined.

b. The "daily maximum" discharge means the total discharge during any calendar day.

c. The "30-day average concentration", other than for fecal coliform bacteria, means the arithmetic mean of measurements made during a month. The "30-day average concentration" for fecal coliform bacteria means the geometric mean of measurements made during a month. The geometric mean is the nth root of the product of n numbers.

If fewer than four measurements are made during a month, the compliance or noncompliance with the 30-day average concentration limitation shall not be determined.

d. The "daily maximum" concentration means the measurement made on any single discrete sample or composite sample.

e. A "discrete" sample means any individual sample collected in less than 15 minutes.

f. A "composite" sample means, for flow rate measurements, the arithmetic mean of no fewer than four (4) individual measurements taken at equal time intervals for eight (8) hours, or for the duration of discharge, whichever is shorter. A "composite" sample means, for other than flow rate measurements, a combination of no fewer than four (4) individual samples obtained at equal time intervals for either (8) hours, or for the duration of discharge, whichever is shorter. The volume of each individual sample shall be proportional to the discharge flow rate at the time of sampling.

4. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations (40 CFR, Part 136) published pursuant to Section 304(h) of the Act, under which such procedures may be required unless other procedures are approved by the Division.

Part I.C. (continued)

5. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. the exact place, date, and time of sampling;
b. the dates the analyses were performed;
c. the person(s) who performed the analyses;
d. the analytical techniques or methods used; and
e. the results of all required analyses.

6. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form. Such increased frequency shall also be indicated.

7. Records Retention

All records and information resulting from the monitoring activities required by this permit, including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation, shall be retained for a minimum of three (3) years, or longer if required by the Director.

8. Modification of Monitoring Frequency and Sample Type

After considering monitoring data, stream flow, discharge flow and receiving water conditions, the Division of Environmental Protection may, for just cause, modify the monitoring frequency and/or sample type by issuing an order to the permittee.

9. Permit Modification and Reissuance

This permit may be modified, or alternatively, revoked and reissued, to comply with any applicable effluent limitation issued pursuant to the order of the United States District Court for the District of Columbia issued on June 8, 1976, in Natural Resources Defense Council, Inc. et al. v Russell E. Train, 8 ERC 2120 (D.D.C. 1976), if the effluent limitations so issued:

a. is different in conditions or more stringent than any effluent limitations in the permit; or

b. controls any pollutant not limited in the permit.

PART II

A. MANAGEMENT REQUIREMENTS

1. Change in Discharge

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions, or treatment modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Any changes to the permitted treatment facility must comply with Nevada Administrative Code (NAC) 445.179 to 445.181. Pursuant to NAC 445.174, the permit may be modified to specify and limit any pollutants not previously limited.

2. Facilities Operation

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities, collection systems or pump stations installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

3. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to receiving waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Noncompliance, Unauthorized Discharge, Bypassing and Upset

a. Any diversion, bypass, spill, overflow or discharge of treated or untreated wastewater from facilities described in Part II.A.2 of this permit is prohibited except as authorized by this permit. I the event the permittee has knowledge that a diversion, bypass, spill, overflow or discharge not authorized by this permit is probable, the permittee shall notify the Division of Environmenta Protection immediately.

b. The permittee shall notify the Division of Environmental Protection within twenty-four (24) hours of any diversion, bypass, spill, upset, overflow or discharge of treated or untreated sewag other than that which is authorized by the permit. A written

Part II.A. (continued)

report shall be submitted to the Director within five (5) days of diversion, bypass, spill, overflow, upset or discharge, detailing the entire incident including:

(1) time and date of discharge;
(2) exact location and estimated amount of discharge;
(3) flow path and any bodies of water which the discharge reached;
(4) the specific cause of the discharge; and
(5) the preventive and/or corrective actions taken.

c. The following shall be included as information which must be reported orally within 24 hours: any unanticipated bypass which exceeds any effluent limitation in the permit; any upset which exceeds any effluent limitation in the permit; and violation of a limitation for any toxic pollutant or any pollutant identified as the method to control a toxic pollutant.

d. The permittee shall report all instances of noncompliance not reported under Part II.A.4.b. at the time monitoring reports are submitted. The reports shall contain the information listed in Part II.A.4.b.

e. An "upset means an exceptional incident in which there is unintentional and temporary noncompliance with the permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

f. In selecting the appropriate enforcement option, the Division of Environmental Protection shall consider whether or not the noncompliance was the result of an upset.

g. The burden of proof is on the permittee to establish that an upset occurred.

In order to establish that an upset occurred, the permittee must provide, in addition to the information required under paragraph II.A.4.b. above, properly signed contemporaneous logs or other documentary evidence that:

(1) The facility was at the time being properly operated as required in paragraph II.A.2 above; and

(2) All reasonable steps were taken to minimize adverse impacts as required by paragraph II.A.3 above.

Part II.A. (continued)

5. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of waste waters shall be disposed of in a manner such as to prevent any pollution from such materials from entering any navigable waters.

6. Safeguards to Electric Power Failure

In order to maintain compliance with the effluent limitations and prohibitions of this permit the permittee shall either:

a. provide at the time of discharge an alternative power source sufficient to operate the wastewater control facilities;

or, if such alternative power is not in existence,

b. halt or reduce all discharges upon the reduction, loss, or failure of the primary source of power to the waste water control facilities.

B. RESPONSIBILITIES

1. Right of Entry

The permittee shall allow the Director and/or his authorized representatives, upon the presentation of credentials:

a. to enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b. at reasonable times, to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to perform any necessary sampling to determine compliance with this permit or to sample any discharge.

2. Transfer of Ownership or Control

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the permittee shall notify the succeeding owner or controller of the existence of this permit, by letter, a copy of which shall be forwarded to the Director. All transfer of permits shall be approved by the Division of Environmental Protection.

Part II.B. (continued)

3. Availability of Reports

Except for data determined to be confidential under NRS 445.311, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the office of the State. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in NRS 445.337.

4. Furnishing False Information and Tampering with Monitoring Devices

Any person who knowingly makes any false statement, representation, or certification in any application, record, report, plan or other document filed or required to be maintained by the provisions of NRS 445.131 to 445.354, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, or who falsifies, tampers with or knowingly renders inaccurate any monitoring device or method required to be maintained under the provisions of NRS 445.131 to 445.354, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, is guilty of a gross misdemeanor and shall be punished by a fine of not more than $10,000 or by imprisonment in the county jail for not more than 1 year, or by both fine and imprisonment. This penalty is in addition to any other penalties, civil or criminal, provided pursuant to NRS 445.131 to 445.354, inclusive.

5. Penalty for Violation of Permit Conditions

Nevada Revised Statutes (NRS) 445.317 provides that any person who violates a permit condition is subject to administrative and judicial sanctions as outlined in NRS 445.324 through 445.334.

6. Permit Modification, Suspension or Revocation

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. violation of any terms or conditions of this permit;

b. obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. a change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

Part II.B. (continued)

7. Toxic Pollutants

Notwithstanding Part II.B.6 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard in prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

8. Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable Federal, State or local laws, regulations, or ordinances.

9. Property Rights

The issuance of this permit does not convey any property rights, in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provisions of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

PART III

A. OTHER REQUIREMENTS

1. Reapplication

If the permittee desires to continue to discharge, he shall reapply not later than 180 days before this permit expires on the application forms then in use.

2. Signatory Requirements

a. Applications. All permit applications shall be signed as follows:

(1) For a corporation: by a responsible corporate officer. For the purposes of this section, a responsible corporate officer means (a) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (b) the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

(2) For a partnership or sole proprietorship: by a general partner or proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected offical. For purposes of this section, a principal executive officer of a Federal agency includes (a) the chief executive officer of the agency, or (b) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

b. Reports. All reports required by permits and and other information requested by the Director shall be signed by a person described in paragraph a. of this section, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described in paragraph a. of this section;

Part III.A.2.b. (continued)

(2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, or position of equivalent responsibility. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and

(3) The written authorization is submitted to the Division.

c. Changes to authorization. If an authorization under paragraph b. of this section is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph b. of this section must be submitted to the Division prior to or together with any reports, information, or applications to be signed by an authorized representative.

d. Certification. Any person signing a document under paragraphs a. or b. of this section shall make the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

3. Holding Pond Conditions

If any wastewater from the permittee's facility is placed in ponds, such ponds shall be located and constructed so as to:

a. contain with no discharge the once-in-one-hundred year storm at said location;

b. withstand with no discharge the once-in-one-hundred year flood of said location; and

c. prevent escape of wastewater by leakage other than as authorized by this permit.

1.) a. Facility name KATHERINE LANDING 08-701

b. Facility Owner NATIONAL PARK SERVICE

c. Name, title, address, and telephone number of contact person for facility.

Name: EVERETT ROBERTSON

Title: CHIEF OF PARK MAINTENANCE

Mailing address: 601 Nevada Highway
Boulder City, NV
Zip Code 89005

Telephone number: 702-293-4041
(Area Code)

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RECEIVED
WATER QUALITY
CONTROL

d. Address and telephone number of facility:

Mailing address: NPS Lake Mohave
Bullhead City, AZ
Zip Code 86430

Telephone number: 602-754-3700
(Area Code)

e. Facility location information:

SAME AS ABOVE

Zip Code

MOHAVE County, Arizona

Township 21 North

Range 21 West

Section Sec. 6

½ ½

ADHS/BWQM-218 (1/84)
Revised 7/84

Part III.A. (continued)

4. Flow Rate Notification

The permittee shall notify the Director, by letter, not later than ninety (90) days after the 30-day average daily influent flow rate first equals or exceeds 85% of the design treatment capacity of the permittee's facility given in Part I.A. above. The letter shall include:

a. The 30-day average daily influent flow rate;

b. The maximum 24 hour flow rate during the 30 day period reported above and the date the maximum flow occurred.

c. The permittee's estimate of when the 30-day average influent flow rate will equal or exceed the design treatment capacity of the permittee's facility; and

d. the permittee's schedule of compliance to provide additional treatment capacity before the 30-day average daily influent flow rate equals the present design treatment capacity of the permittee's facility.

The permittee shall implement and comply with the provisions of the schedule of compliance after approval by the Director, including in said implementation and compliance, any additions or modifications which the Director may make in approving the schedule of compliance.

f. Describe access to facility Take Ariz. Hwy 68 to Katherine Landing access road, turn right on the Katherine Landing road and go about 2-3/4 miles to the first paved road to the right. Take this road for about 3/4 mile to the first good dirt road to the left. (Just before the cattle guard on the paved road) Go to end of dirt road, around sewer lagoons, this is where the Katherine water treatment plant is.

g. Landowner of facility site NATIONAL PARK SERVICE

h. Type of Permit you are applying for:

area permit ______ individual facility permit X

i. Type of facility requesting permit:

new ______ existing X

2.) a. Attach a topographic map (preferably a 7.5 minute quadrangle base), showing the geographic location of the facility(s) and all disposal locations. In addition, show the location of any existing groundwater withdrawal wells within the approximate vicinity (¼ mile radius) of the disposal area and identify the use of each well (i.e. industrial wells, drinking water supply wells, etc.). (If applying for an area permit as described in R9-20-211, indicate on the map the location of each facility and disposal location in the proposed permitted area).

DAVIS DAM
U.S.G.S. QU.
Attached
hereto.

b. List Latitude/Longitude of all disposal locations indicated on the attached map LAT. 35°13' long 114°33'

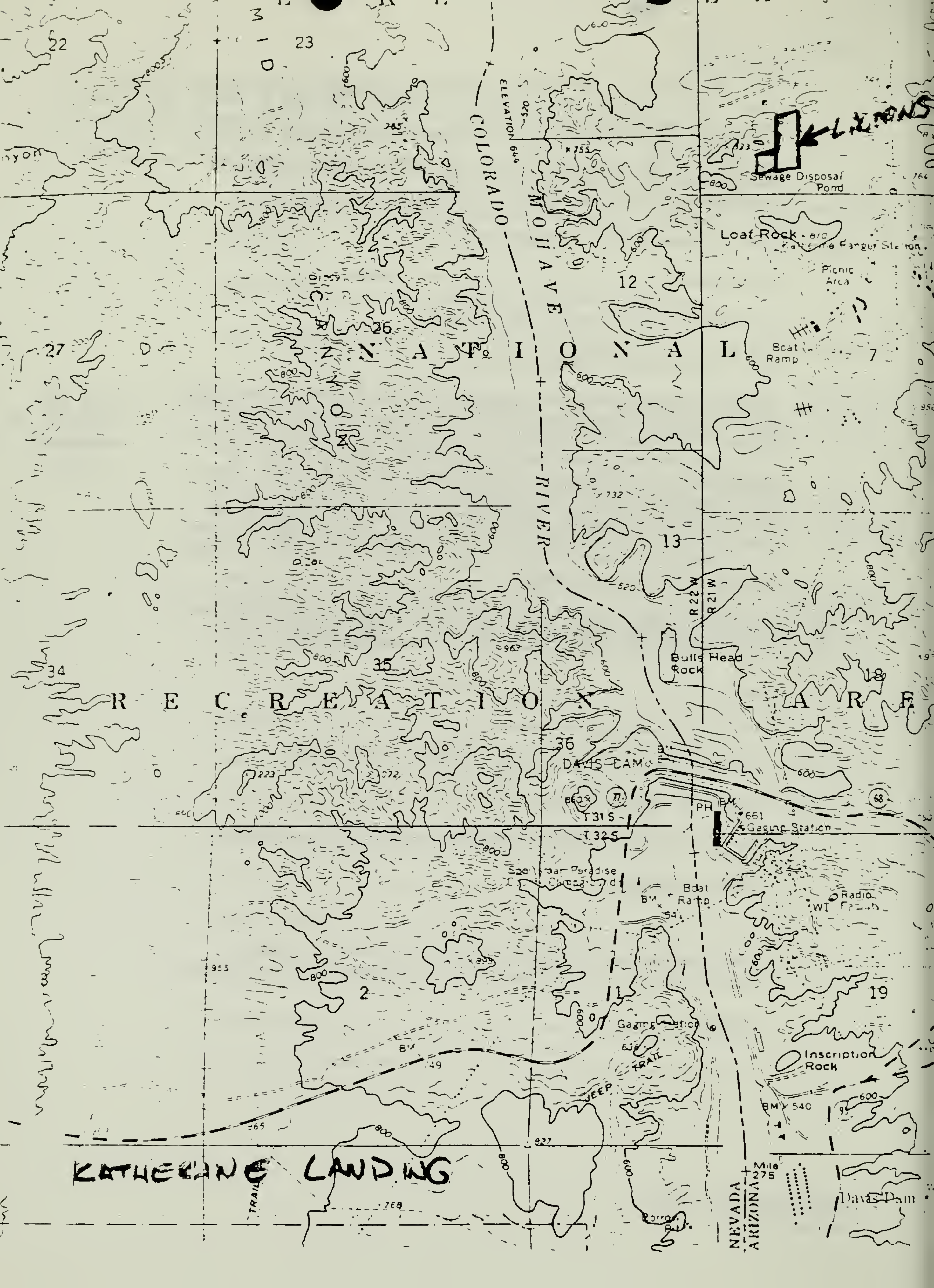
3.) a. Type of Facility(s) Sewage disposal facilities

b. Nature of Activity conducted at facility(s)

Non-overflowing evaporative pond system for treatment of domestic sewage.

c. List applicable U.S. Department of Commerce Standard Industrial Classification (SIC) Codes for above activities

Unknown


LAGOONS
Sewage Disposal Pond
Loaf Rock
810
Katherine Ranger Station
Picnic Area
Boat Ramp
COLORADO RIVER
ELEVATION 644
MOHAVE
LAKE MEAD NATIONAL RECREATION AREA
22
23
26
27
34
35
36
2
1
12
13
7
18
19
x 755
765
x 732
x 967
633
520
600
800
R 22 W
R 21 W
Bulls Head Rock
DAVIS DAM
68
PH
BM
661
Gaging Station
T 31 S
T 32 S
Sportsman Paradise Camp Campground
Boat Ramp
BM 541
Radio WT Facility
Gaging Station
JEEP TRAIL
TRAIL
BM 549
Inscription Rock
BM 540
Mile 275
NEVADA
ARIZONA
Davis Dam
827
768
KATHERINE LANDING

4.) Date Facility began/will begin operating 1980

5.) Expected Facility(s) Operational Lifetime 50 years

6.) List any other environmental permits issued to the facility(s) (i.e. air quality permit, NPDES permit, hazardous waste permit)

Unknown

7.) a. Describe disposal acitivites at the facility(s)

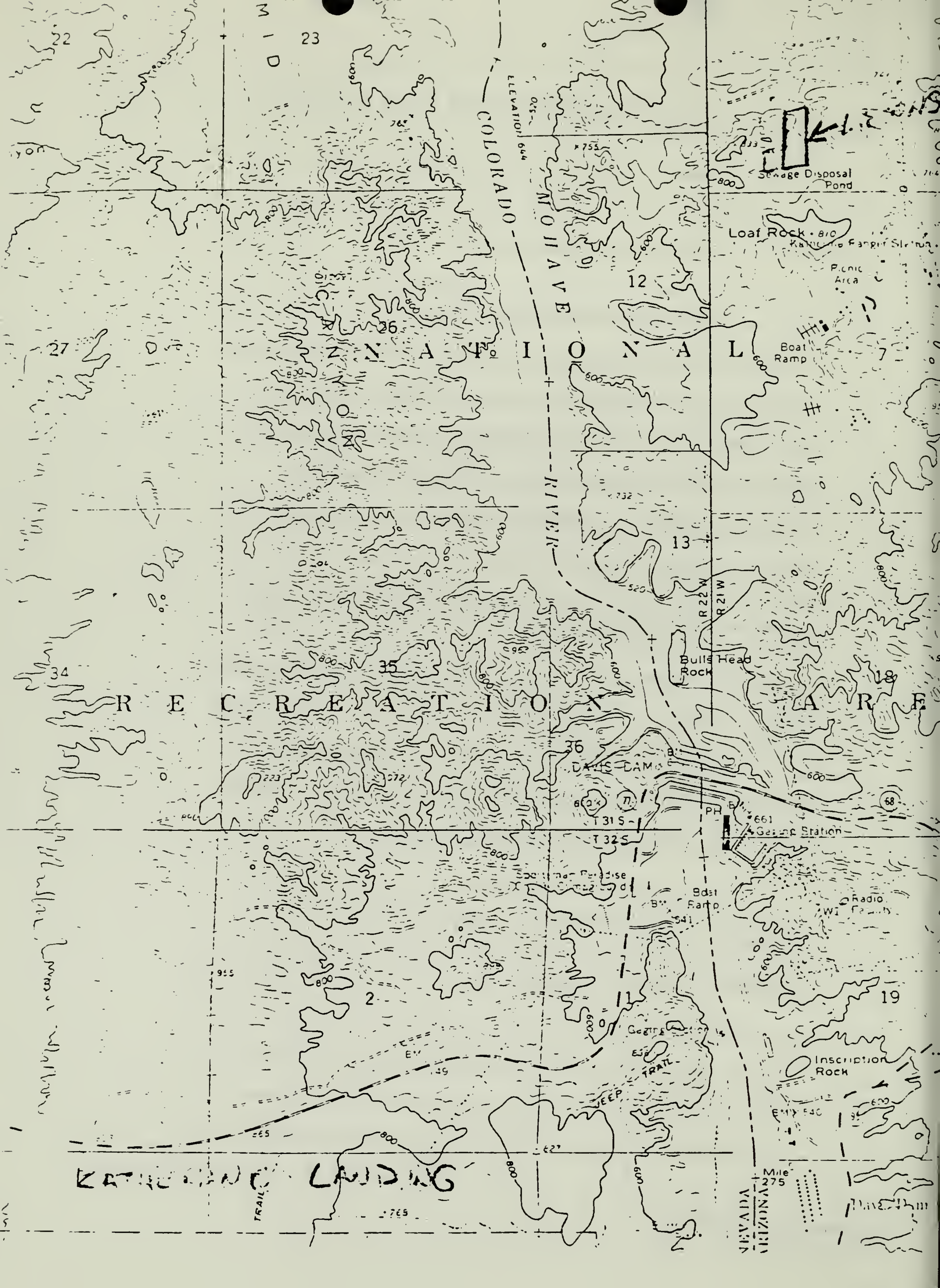
The lagoon system consists of a lined primary and secondary pond with a third evaporative pond. Sewage processing in the primary pond is aerobic-symbiotic-algae stabalization assisted by mechanical automated aerators and natural evaporation; further processed naturally in the third non-over-flowing evaporative pond.

b. Describe any control measures and treatment processes designed and operated to protect groundwater quality from effects of the disposal

As discribed above there is no disposal of untreated domestic sewage influent or treated effluent lagoon waters that enter into or upon ground or surface waters. Sewage lagoons are checked daily with proper testing and reporting of influent and effluent weekly or oftener if necessary.

c. Describe existing groundwater use(s) of the receiving aquifer(s)

No seepage into ground water.

22
23
27
34
35
26
12
13
36
2
1
7
18
19
LAKE MOHAVE NATIONAL RECREATION AREA
COLORADO RIVER
ELEVATION 644
Sewage Disposal Pond
Loaf Rock 810
Katherine Ranger Station
Picnic Area
Boat Ramp
Bulls Head Rock
DAVIS DAM
PH
661
Gaging Station
T 31 S
T 32 S
R 22 W
R 21 W
Sportsman Paradise
Boat Ramp
541
Radio Facility
Gaging Station
JEEP TRAIL
TRAIL
Inscription Rock
Mile 275
NEVADA
ARIZONA
68
77
600
800
955
765
732
KATHERINE LANDING

d. Note of depth to groundwater 150 feet

Source of data Ground water assumed to be lake level. Lagoon elevation estimated from U.S.G.S. Quads.

Date of measurement ______

e. Enter in Appendix A - Part I the ambient groundwater concentrations of the receiving aquifer(s) for those constituents listed that are contained in the disposal. Indicate source of data and date of sampling for all values listed. Attached hereto.

8.) a. Identify the type(s) of waste(s) generated by each process within the facility. Be as descriptive as possible without listing specific constituents.

Domestic sewage

b. Check of list in Appendix A - Part II of the specific pollutants disposed by the facility. Include those disposed materials that are listed in Tables I and II of this document, in Title 40 Code of Federal Regulations Part 261, or any other constituent contained in the disposed waste stream.

c. Enter in Appendix A - Part II the maximum disposal concentration of those constituents you checked or listed, as required by 8b. Indicate the date of sampling in parenthesis next to the sample value and the source of the data at the bottom of page three in Appendix A.

d. Estimate the disposal schedule including the annual average in hours per day, days per year, and the disposal periods if the disposal is seasonal.

Hours/day 24

Days/year 365

Seasonal Distribution of Disposal ______

e. Estimate the flow rate(s) of the disposal (i.e. minimum, average, and maximum daily flow; mean annual flow; or mean, minimum, and maximum flow by season if disposal is periodic; or by whatever other units appropriate to the type of disposal.

AVERAGE 23,000 G/D

9.) Describe any existing groundwater quality monitoring program(s) (attach supporting technical reports if available)

NONE

10.) Include any other data or information which, in the judgement of the owner/operator, demonstrates that the facility qualifies for a groundwater quality protection permit based on compliance with the criteria listed in R9-20-208.A. Use attachments if applicable (i.e. depth to groundwater, geology at the site).

"I certify that under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

Everett Robertson
Printed Name of Applicant

Chief of Park Maintenance
Title

1/11/85
Date Application Signed

Everett Robertson
Signature of Applicant

NOTICE OF DISPOSAL FORM

JAN 1985
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CONTROL

1.) a. Facility name TEMPLE BAR

b. Facility Owner NATIONAL PARK SERVICE

c. Name, title, address, and telephone number of contact person for facility.

Name: EVERETT ROBERTSON

Title: CHIEF OF PARK MAINTENANCE

Mailing address: 601 Nevada Highway
Boulder City, NV
Zip Code 89005

Telephone number: 702-293-4041
(Area Code)

d. Address and telephone number of facility:

Mailing address: NATIONAL PARK SERVICE
TEMPLE BAR, ARIZONA
Zip Code 86443

Telephone number: 602-767-3401
(Area Code)

e. Facility location information:

Zip Code

MOHAVE County, Arizona

Township 31N-

Range 19W

Section

½ ½

f. Describe access to facility Highway 93 North from Kingman, approximately 50 miles to Temple Bar turnoff, then 28 miles to NPS facility.

g. Landowner of facility site National Park Service

h. Type of Permit you are applying for:

area permit ______ individual facility permit X

i. Type of facility requesting permit:

new ______ existing X

2.) a. Attach a topographic map (preferably a 7.5 minute quadrangle base), showing the geographic location of the facility(s) and all disposal locations. In addition, show the location of any existing groundwater withdrawal wells within the approximate vicinity (½ mile radius) of the disposal area and identify the use of each well (i.e. industrial wells, drinking water supply wells, etc.). (If applying for an area permit as described in R9-20-211, indicate on the map the location of each facility and disposal location in the proposed permitted area).

Virgin Basin U.S.G.S. Quad attached hereto.

b. List Latitude/Longitude of all disposal locations indicated on the attached map

36°02' LOT

114°20' LONG

3.) a. Type of Facility(s) Sewage Disposal Facilities

b. Nature of Activity conducted at facility(s)

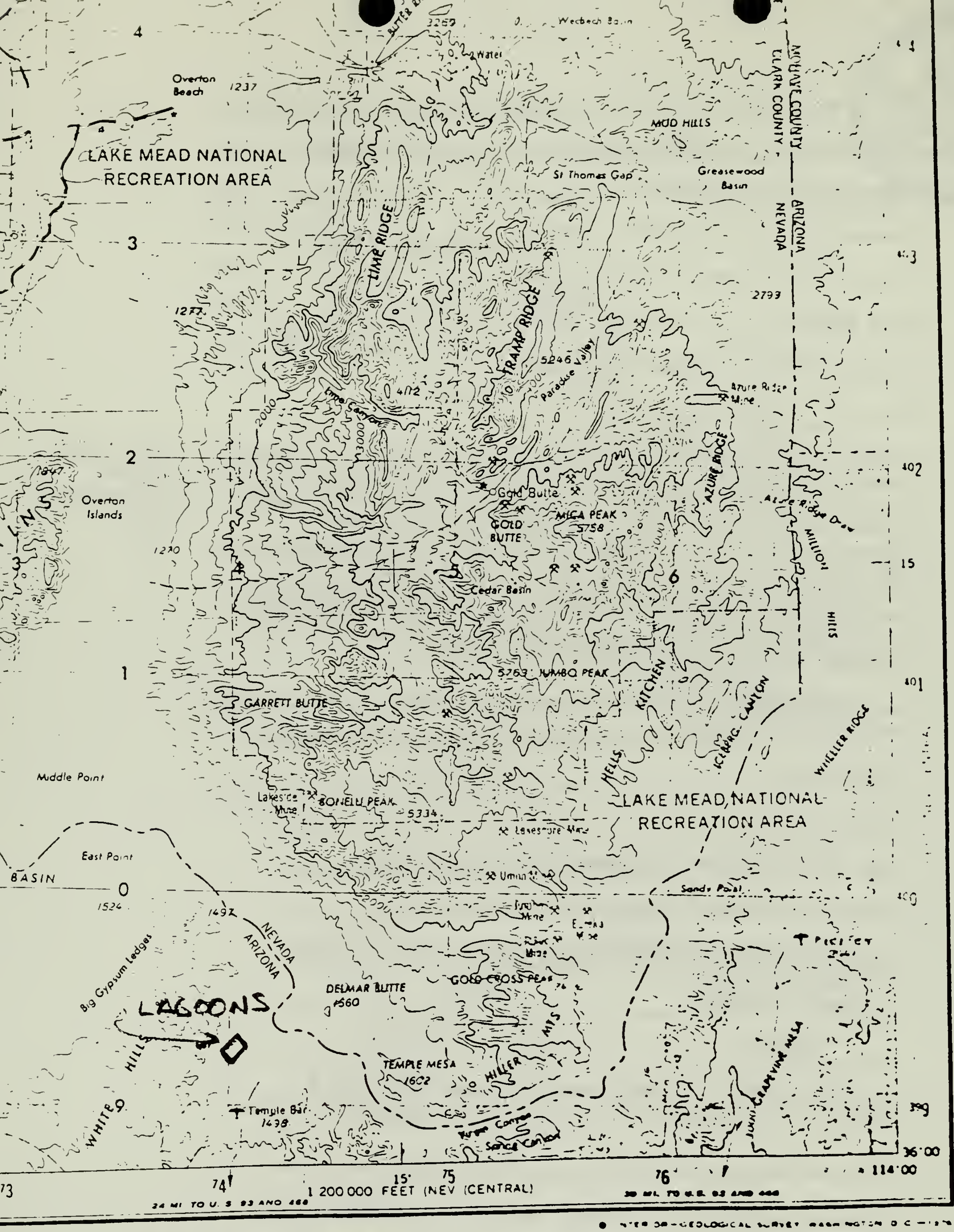
Non-overflowing evaporative pond system, for treatment of domestic sewage.

Unknown

c. List applicable U.S. Department of Commerce Standard Industrial Classification (SIC) Codes for above activities

______

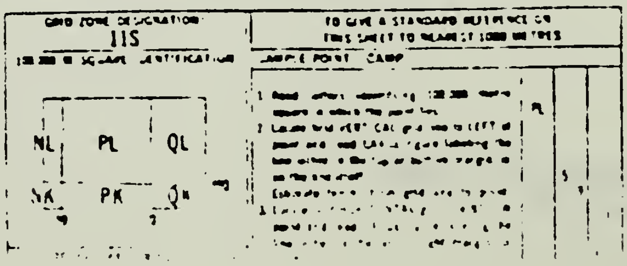
______



INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1976

STOCK NO. V502XNJ1112-05

TEMPLE BAR


GRID ZONE DESIGNATION
11S
100,000 M SQUARE IDENTIFICATION
TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 1000 METRES
SAMPLE POINT: CAMP
NL
PL
QL
NK
PK
QK

OVER 25,000 MAPS

4.) Date Facility began/will begin operating 1981

5.) Expected Facility(s) Operational Lifetime 50 years

6.) List any other environmental permits issued to the facility(s) (i.e. air quality permit, NPDES permit, hazardous waste permit)

7.) a. Describe disposal acitivites at the facility(s)

The lagoon system consists of a lined primary and secondary pond with a third evaporative pond. Sewage processing in the primary and secondary ponds is aerobic-symbiotic-algae stabilization assisted by mechanical automated aerators and natural evaporation; further processed naturally in the third non-over-flowing evaporative pond.

b. Describe any control measures and treatment processes designed and operated to protect groundwater quality from effects of the disposal As described above there is no disposal of untreated domestic sewer influent or treated effluent lagoon waters that enter into or upon ground or surface waters. Sewage lagoons are checked daily with proper testing and reporting of influents and effluents weekly or oftener if necessary.

c. Describe existing groundwater use(s) of the receiving aquifer(s)

No seepage into ground waters.

d. Note of depth to groundwater 100 feet

Source of data Ground water assumed to be lake elevation
Lagoon elevation estimated from U.S.G.S. Quads - attached hereto.

Date of measurement ____________________

e. Enter in Appendix A - Part I the ambient groundwater concentrations of the receiving aquifer(s) for those constituents listed that are contained in the disposal. Indicate source of data and date of sampling for all values listed.

8.) a. Identify the type(s) of waste(s) generated by each process within the facility. Be as descriptive as possible without listing specific constituents.

Domestic sewage.

b. Check of list in Appendix A - Part II of the specific pollutants disposed by the facility. Include those disposed materials that are listed in Tables I and II of this document, in Title 40 Code of Federal Regulations Part 261, or any other constituent contained in the disposed waste stream.

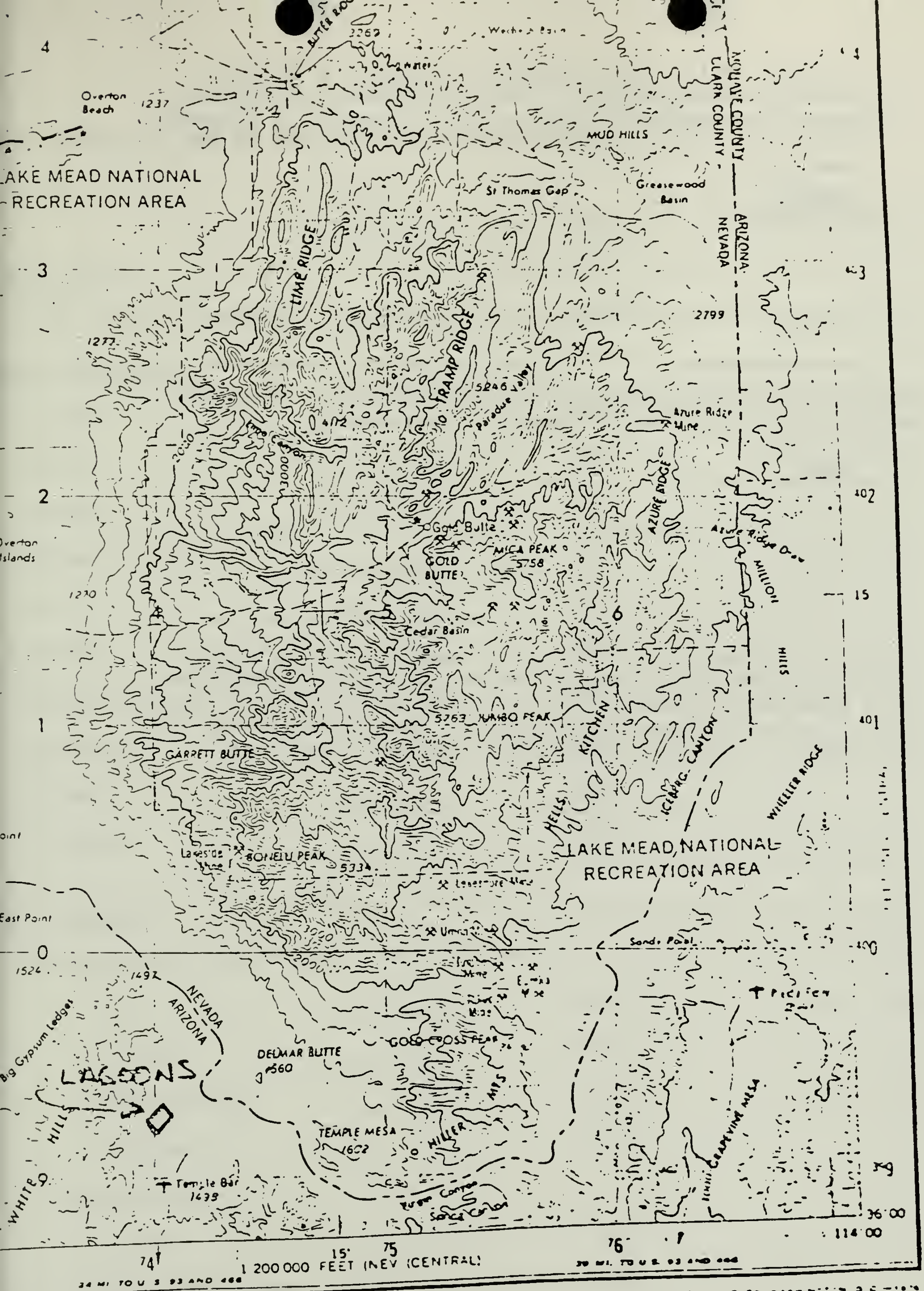
c. Enter in Appendix A - Part II the maximum disposal concentration of those constituents you checked or listed, as required by 8b. Indicate the date of sampling in parenthesis next to the sample value and the source of the data at the bottom of page three in Appendix A.

d. Estimate the disposal schedule including the annual average in hours per day, days per year, and the disposal periods if the disposal is seasonal.

Hours/day 24

Days/year 365

Seasonal Distribution of Disposal ____________________



TEMPLE BAR

11S

YL PL QL

YK PK QK

STOCK NO. V502XNJ1112••05

OVER 25,000 MAPS

e. Estimate the flow rate(s) of the disposal (i.e. minimum, average, and maximum daily flow; mean annual flow; or mean, minimum, and maximum flow by season if disposal is periodic; or by whatever other units appropriate to the type of disposal.

AVERAGE 35,000 G/D

9.) Describe any existing groundwater quality monitoring program(s) (attach supporting technical reports if available)

NONE

10.) Include any other data or information which, in the judgement of the owner/operator, demonstrates that the facility qualifies for a groundwater quality protection permit based on compliance with the criteria listed in R9-20-208.A. Use attachments if applicable (i.e. depth to groundwater, geology at the site).

Appendix A - NOTICE OF DISPOSAL FORM

ient Groundwater and Maximum Disposal Waste Stream Constituent Concentrations

	PART I Ambient Groundwater	Units	PART II Disposal Waste Stream
robiological			
Fecal Coliform Bacteria		#/100 ml	
rganic Chemicals			
Arsenic		mg/l	
Barium		mg/l	
Cadmium		mg/l	
Chromium (Total)		mg/l	
Lead		mg/l	
Mercury		mg/l	
Nitrate (as N)		mg/l	
Selenium		mg/l	
Silver		mg/l	
Fluoride		mg/l	
ganic Chemicals			
Chlorinated Hydrocarbons			
Endrin		mg/l	
Lindane		mg/l	
Methoxychlor		mg/l	
Toxaphene		mg/l	
Chlorophenoxys			
2, 4-D		mg/l	
2, 4, 5TP Silvex		mg/l	
Total Trihalomethanes		mg/l	

ADHS/BWWQM-218 (1/84)
Revised 7/84

	PART I Ambient Groundwater	Units	PART II Disposal Waste Stream
Radiochemicals			
Combined radium-226 and radium-228	________	pCi/l	________
Gross alpha particle activity (including radium-226 but excluding radon and Uranium)	________	pCi/l	________
Beta particle and photon emitters from man-made radionuclides	________	pCi/l	________
Secondary Contaminants			
Alkalinity	________	mg/l	________
Calcium	________	mg/l	________
Chloride	________	mg/l	________
Copper	________	mg/l	________
Hardness	________	mg/l	________
Iron	________	mg/l	________
Magnesium	________	mg/l	________
Manganese	________	mg/l	________
pH	________	mg/l	________
Sodium	________	mg/l	________
Sulfate	________	mg/l	________
Total Dissolved Solids (TDS)	________	mg/l	________
Zinc	________	mg/l	________

	PART I Ambient Groundwater	Units	PART II Disposal Waste Stream
ority Pollutants			

hers: (list all other constituents contained in the disposal waste stream)

urce of data: ______________________________

____

ADHS/BWWQM-218 (1/84)
Revised 7/84

APPENDIX C

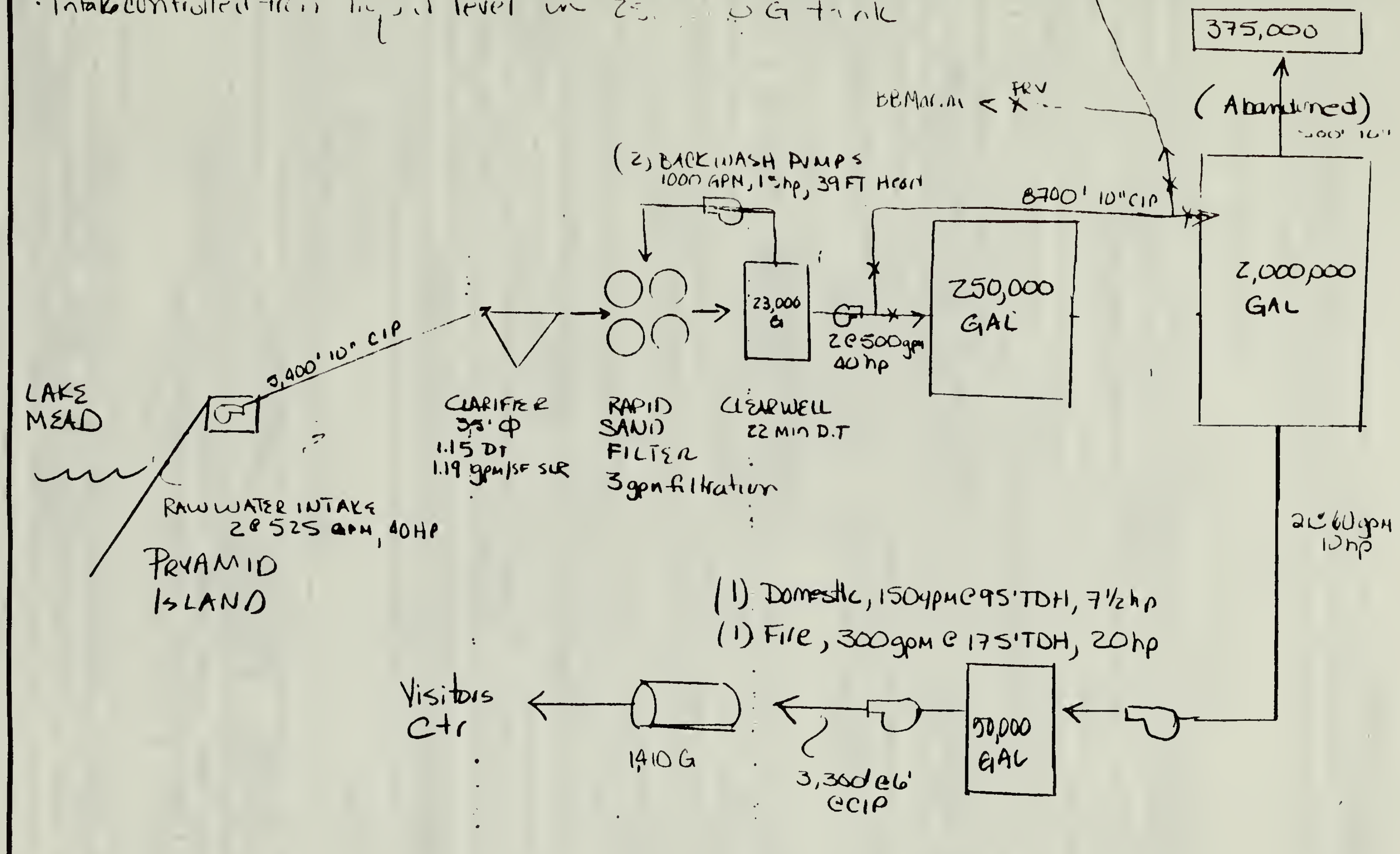
FORM D S C - 44

Park Lame	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**	**Sheet** 1
Area Boulder Beach Water Tx		**of** 3
Project	**By** / **Checked**	**Pkg.** 587
Feature [illegible]	**Date** / **Date**	**Account**

Boulder Beach [illegible] Plant Effluent [illegible] [illegible]

ARV → Hemenway Wash

· Intake controlled from [illegible] level in 25[illegible] G tank



Check out [illegible]
2) specification SS-300A-1/2
SS-3000-1/2

2/1

LAKE MEAD WATER AND SEWER STUDY
Package No. 587
WATER SYSTEM INFORMATION

LOCATION Boulder Beach
DATE OF INSPECTION
INSPECTED BY

RAW WATER:
Source Alternate Sources
Intake Pump Capacity: Mfg I.D.
Intake Pump Motor Capacity Mfg I.D.
Force Main Size Length Material
Storage Capacity Tank Type
Irrigation System
Water Quality: Alkalinity Arsenic Coliform
pH Total Dissolved Solids Turbidity
Comments
2 pumps on line Square D circuit breaker
installed 3 years ago D 600 V AC / 250 V DC

Hydropneumatic Tank: WPXR Model, 1967 Installation
Serial M6336
100 psi 60" X 9'7 1/4" w/ .375" wall th

Pumps Peerless Vertical Turbine
Q? TDH

TREATED WATER:
Design Capacity Ave. Mo Demand 499,995 Peak Mo Demand
D.O.I. 1968 Mfg Infilco
Clarifier Dia. Overflow Rate
Filter Type Filter Depth Filter Controls
Backwash Rate Backwash Pump Capacity
Backwash Storage
Clear Well Storage Treated Water Storage 375,000 [illegible]
Comments 102' ϕ y 33'2", 27' fire level DOI - 1964, Pittsburgh Des Moines 34770 [illegible]
Booster Pumps 250,000 G e
[illegible] model 3333, 10 hp 50,000 G [illegible]
pumps to [illegible]

interior of 250,000 G tank, clarifier & filter painted in 1983

DISTRIBUTION SYSTEM:
Pipe Size Length Material
Comments
~~2173' - 8" CAP 275' GSP 2376' PVC~~
~~3460' - 6" AC 1,415' CAP~~
power cable outer sleeve broken in several places
(ϕ individually wrapped - appear okay)

GENERAL COMMENTS:
~~1982~~ drawings
~~Pump~~ house on Pyramid Island - no railing around structure
- difficult to open hatches
- interior steps in poor shape

3/13

S. 1 Peerless Pumps - Vertical Turbine
amt)

Q? TDH?
pump 1: Gould model 3333, sn CB4560110225C, serial 268B394
Marathon Electric Motor, MC213TTDE8312BNL, 3475 rpm
(or U?

S. 2
(tank)
carlon sparling meter

Q? TDH?
Pump 2: Gould model 3333 sn CB4560110225C, serial 2683399
Marathon Electric MC213TTDR8312BNL
(0 IN

S. 3
tors Ctr)

Pump 1: 1½W7½-2 Cornell (Serial # 5775-6 7/16)
Q = 150? TDH = 725 (est from curve)
Motor 1: GE 5K18AUL57, 7½hp 230/460V 3φ
3510 rpm, 184TCZ frame

rior compressor
g poorly
ated.

Pump 2: 2½WZ Cornel (serial 577-6)
Q = ? TDH = ?
Motor 2: GE Tri dad 5K256XAM102 model #
CCJ301372 serial #

25hp 3530 rpm 230/460V

Air Compressor

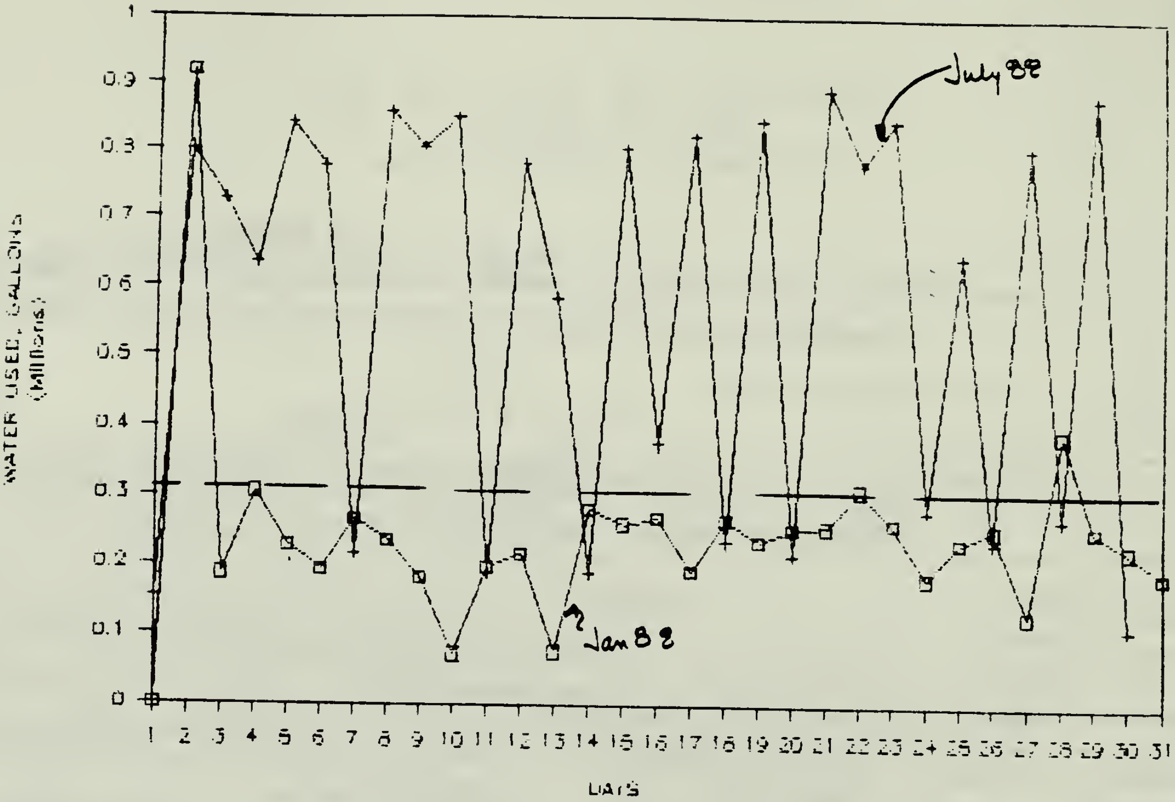
Controls = Mercury Switch - Flotrol
serial FT-P012-2

mpty - 40psi @ 18% tank Vol
Full - 60psi @ 40% tank Vol
poor condition

Compressor Quincy model 216-39, 3×2½
serial 584818C (or L)

Circuit Breaker Westinghouse #RKA, 452D137G06
225amp,

Boulder Beach



310,

Boulder Beach – BACKGROUND INFORMATI

Visitation!

	Total Visitation	Ave daily
1986	2,418,091	6,624
1987	2,301,624	6,306
1988	2,145,795	5,878

Ave daily / 86-88 = 6,269

MONTHLY / DAILY

# units		Anr Aveday	1/88	3/88	5/88	7/88
44	Lake Mead Lodge	23	322/10	329/11	724/23	1437/
290	Trailer Village	353	11,777/380	11,613/375	9,983/322	10451/
388	Campground (Boulder)	215	4,257/137	,042/324	7778/251	4610
	Campground (Hemenway)	65	1,211/40	6,442/208	284/10	–
	Primitive Campground	7	221/1	921/30	1376/44	3914/
400 slips	Marina	?	782/25	1657/53	3656/118	3221/
314 seats	Restaurant					14

Employees

NPS 16 units @ 3 PE/unit = 48 PE

Concessioner None

FORM DSC-44

Park LAME	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 5
Area Boulder Beach			**of** 13
Project	**By** DH	**Checked**	**Pkg.** 587
Feature Filter Plant Capacity	**Date** May 1984	**Date**	**Account**

Qpk design = 1.5 MGD = 1042 gpm

Clarifier = 35'Φ   DT = $(17.5)^2(\pi)(7.48)(15)$ = 108,000G

Filters 4 @ 10'-6" Φ DT_{pk} = 104 mins

A = 346 SQF (TOTAL) DT_{ADD} = 346 mins

86.6 SQFT/EA

Filtration Rate = $\frac{1042\text{ gpm}}{346\text{ SQFT}}$ = 3.01 gpm/SF

Clearwell 6.7'H × 38'L × 12'W = 3055 f³

$3055\text{ f}^3 \times \frac{d}{1{,}500{,}000\text{ g}} \times \frac{24\text{ hr}}{d} \times \frac{60\text{ M}}{\text{hr}} \times \frac{7.48\text{ g}}{\text{f}^3}$ = 22 mins ✓

short on detention time,

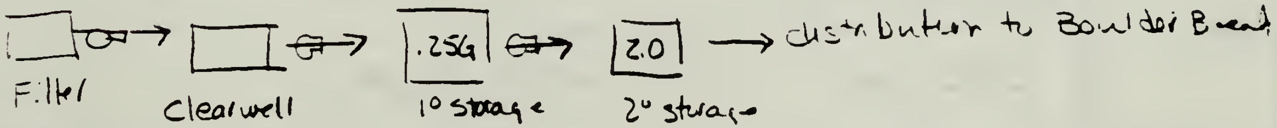
consider [illegible] plant site!

d = [illegible]

[illegible] = 33,422 f³ primary storage @ site

DT = $(250{,}000 + 23{,}000)\text{G} \times d/1500000\text{G} \times 24\text{ hr}/d \times 60\text{ M}/\text{hr}$ = 262 mins (4.7 hours)

Considering the path in which treated water is distributed to system, use of both the clearwell and primary storage tank would provide adequate detention time.



•U.S. GPO: 1984-778-378

FORM D S C - 44

Park LamE	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet**	
Area BB-Visitors Ctr.			**of** /	
Project	**By** DAC	**Checked**	**Pkg.** 5	
Feature domestic water req	**Date** May	**Date**	**Account**	

$V_{stor} = 50{,}000$ G

* staff notes extremely low pressures (20psi) during high visitation & irrigation.

Hydropneumatic Tank 47½" ϕ × 5' length
- no bladder

V_{Tank} = 2705 gallons

mfr recommended starts/hour 3-5 starts
@ 40% Volume
try lowest

$Q = (.4)(2705 \text{ gallons}) \times 4 \frac{\text{starts}}{\text{hr}} = 1080$ Ga

Estimated Demand

	QPK	QAve
* Fire	25 gph	25 gph
Irrigation	1000 gph	3000 gph
Domestic 195 PE / 500 PE	975 gph	2500 gph
	2000 gph (compared to QPK @ 45000 gpd)	5600 gph (compared to 16,000 g

*separate pump for fire flow capable of 500 gpm continuous pumping

FORM D S C - 44

Park LAME	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**	Sheet 7
Area Boulder Beach		of 13
Project	By DAC | Checked	Pkg. 537
Feature Current & Projected Water Use	Date May 1989 | Date	Account

Boulder Beach - Estimated Daily Visitation

1/88	319
3/88	320
5/88	402
7/88	378

Ave 354 visitors/day

Water Pumped - Current Records

Q_{ave} = 450,000 gpd (312 gpm)

Q_{pk} = 748,700 gpd (570 gpm)

Firm Pumping (FPC) available = 1500 gpm

Current F.P.C. > Q_{pk} - ok

Estimate Future Flow

Use +15% increase Q_{ave} = 1.15(450,000 gpd) = 517,000 gpd

Q_{pk} = 1.15(748,700 gpd) = 860,000 gpd

FPC > Q_{pk}^{future}

okay pumping capacity

FORM D S C - 44

Park LAME	NATIONAL PARK SERVICE DENVER SERVICE CENTER			Sheet
Area Boulder Beach				of 1
Project	By		Checked	Pkg. 5
Feature Water Storage	Date May 1989		Date	Account

Estimated Storage Requirements (Min)

Domestic: 450,000 gallons/day (1.15) - 517,000

Fire: 1000 gpm x 120 mins = 120,000

637,500

Is this reasonable - consider area encompassed; consider 3000 gpm @ 120 mins. V_{Fire} = 360,000 G + $V_{Domestic}$

V_T = 877,000 G

≈ say 1×10^6 G

(V_T presently @ 2.1 MG - more than adequate)

Park LAME	NATIONAL PARK SERVICE DENVER SERVICE CENTER		Sheet 9
Area Boulder Beach			of 13
Project	By DAC	Checked	Pkg. 517
Feature Lift Station Capac -	Date 11 Jul 1989	Date	Account

Hemenway Beach

Campground @ 184 sites × 3.3 $\frac{PE}{site}$ × 35 gpcd = 21,252 gpd
(15 gpm)

Day use: 1,152 PE × 10 $\frac{GPD}{PE}$ = 11,520
(8 gpm)

Q Ave 23 gpm

Peaking Factor = 4

Q Peak 92 gpm
(say 95 gpm)

Boulder Beach
Campground & Beach

Campground: 157 sites × 3.3 × 35 gpd = 18,134
80 sites × 5 × 35 gpd = 14,000

32,134 gpd

Q Ave = 28 gpm

Peaking factor @ 4

Q pk = 112 gpm
(say 115 gpm)

FORM D S C - 44

Park LAME	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 1
Area Bould Beach			**of** 1
Project	**By**	**Checked**	**Pkg.** 58
Feature Eval of Sewage Ponds	**Date** May 1989	**Date**	**Account**

Pond	Area
#1	1.4
#2	1.1
#3	2.0
#4	1.9
Total	6.4 Acres

From Park Records

Q_{Ave} = .059 mgd

$Q_{pk Mo}$ - .096 mgd

Detention Time

$$\text{average} = (1.1 + 1.4 \text{ Acre})\left(\frac{43560 \text{ SF}}{A}\right) \times 3\text{FT} \times 7.48 \times \frac{1}{59{,}000} = 42$$

BOD: range: 70-350 mg/l (current quartely sample results)
average:

Organic loading: @ aveQ = $\text{mg/l} \times 8.34 \times \frac{.059}{1.4 \text{ Acres}} = 95$

@ pk Mo Q = $\text{mg/l} \times 8.34 \times \frac{.096}{1.4 \text{ Acres}} =$

FORM D S C - 44

Park LAME	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		Sheet 11
Area Boulder Beach			of 13
Project	By DC	Checked	Pkg. 507
Feature VC Sewage Tr & Disposal	Date March 1989	Date	Account

Q_{VC} (from water records)

$Q_{PK} = 45{,}000$ gpd

$Q_{AVE} = 16{,}000$ gpd

estimate sewage ≈ .6(16,000) = 9,600 gpd

$V_{Tank} = 1{,}125 + .75(9600) = 1{,}125 + .75(9600)$

$= 8323$ gallons

Size of Dosing Tank:

$V = \frac{8300 \text{ gallons}}{4X/\text{day}} = 2075$ gallons/days.

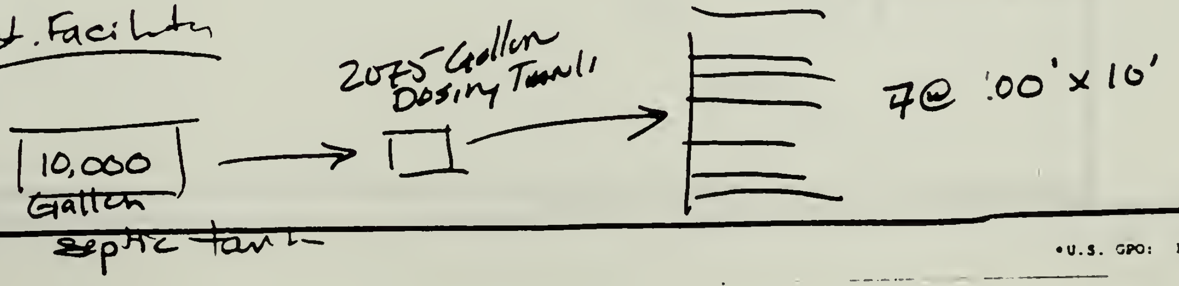
→ try 6' x 6' tank.

Size of field (from onsite manual)

percolation rate est. @ 1.2 gpd/SF

$A = Q/P.R. = \frac{8300}{1.2} = 6{,}916$ S.F.

Est. Facilities



•U.S. GPO: 1984-778-378

FORM D S C - 44

Park LAME	NATIONAL PARK SERVICE DENVER SERVICE CENTER		Sheet 1
Area Boulder Beach			of 13
Project	By NAC	Checked	Pkg. 55
Feature Future Flows	Date May 1987	Date	Account

Future Flows

$Q_{Ave} = 1.15(0.059) = 68,000$ gpd

$Q_{PK} = 1.15(0.096) = 110,000$ gpd

Future loading

$$\frac{270\,\text{mg/l} \times 8.34 \times (.11\ \text{MGD})}{1.4\ \text{Acre}} = 176\ \#\text{BOD/Acre}$$

Future Area Requirements

*based on annual average Q (.068 mgd)

$$A = \frac{Q_{Ave}}{\text{Operating Depth} - (\text{PPT} - \text{EVAP} - \text{PERC})}$$

$$= \frac{3,310,862\ \text{ft}^3}{5 - (.53 - 6.96 - 2)} = \underline{5.7\ \text{Acres}}$$

~~E~~ Available Area > Required Area

•U.S. GPO: 1984-7

FORM DSC-44

Park Lake Mead NRA **Area** Boulder	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 13 **of** 13
Project	**By**	**Checked**	**Pkg.** 537
Feature Sewage Oxygen Requirements	**Date** [illegible] 1989	**Date**	**Account**

Assume that max O_2 [illegible] will be 1.5 × average. 300 [illegible].

Avg O_2 req = .50 @ 300/day

Max O_2 = (1.5)(150) = 225 lb O_2 / day

= 9.4 lbO_2/hr

$$N = \frac{N_a}{\alpha\left[\frac{C_{sw}-C_L}{C_s}\right](1.025)^{T_w-20}} = \frac{9.4\ \frac{lb\,O_2}{hr}}{(.9)\left[\left(\frac{6.8-2}{9.17}\right)\right](1.025)^{28-20}}$$

N = 16.4 lbO_2/hr

Mfgr rating is 3.12 lbO_2/hp hr

$$\text{Power Req'd} = \frac{16.4\,lb\,O_2}{3.12\,lb\,O_2} \times \frac{hp\ hr}{hr} = 5.12\ hp$$

Say 4 aerators @ 2 hp each
(3 fits best but wouldn't want to distribute unequally to ponds)

or 1 7½ hp on each pond

FORM D S C - 44

Park Lake Mead NRA	NATIONAL PARK SERVICE DENVER SERVICE CENTER			Sheet 1
Area Las Vegas Wash				of
Project	By DAC	Checked		Pkg. 58
Feature Estimate Population	Date May 1989	Date		Account

Current visitation - seasonally, average daily

	Jan 88	March 88	May 88	July 88
Campground	137	13[illegible]	60	43
Backcountry	18	[illegible]	59	42
Marina	32	40	32	41
Staff Housing (1)	44	44	44	44
Tot PE (excl. boundary)	213	266	236	122
[illegible]	04	[illegible]	223	[illegible]

(1) estimate from total sq ft available; 125 sq ft / person
(2) assume [illegible] 3% of [illegible] Marina [illegible]

i) Estimate current annual average visitation = $\frac{(2\,3 + 266 + 336 + 123)}{4}$ = 211

ii) Estimate future annual average visitation = 1.15(211) = 242 PE/day

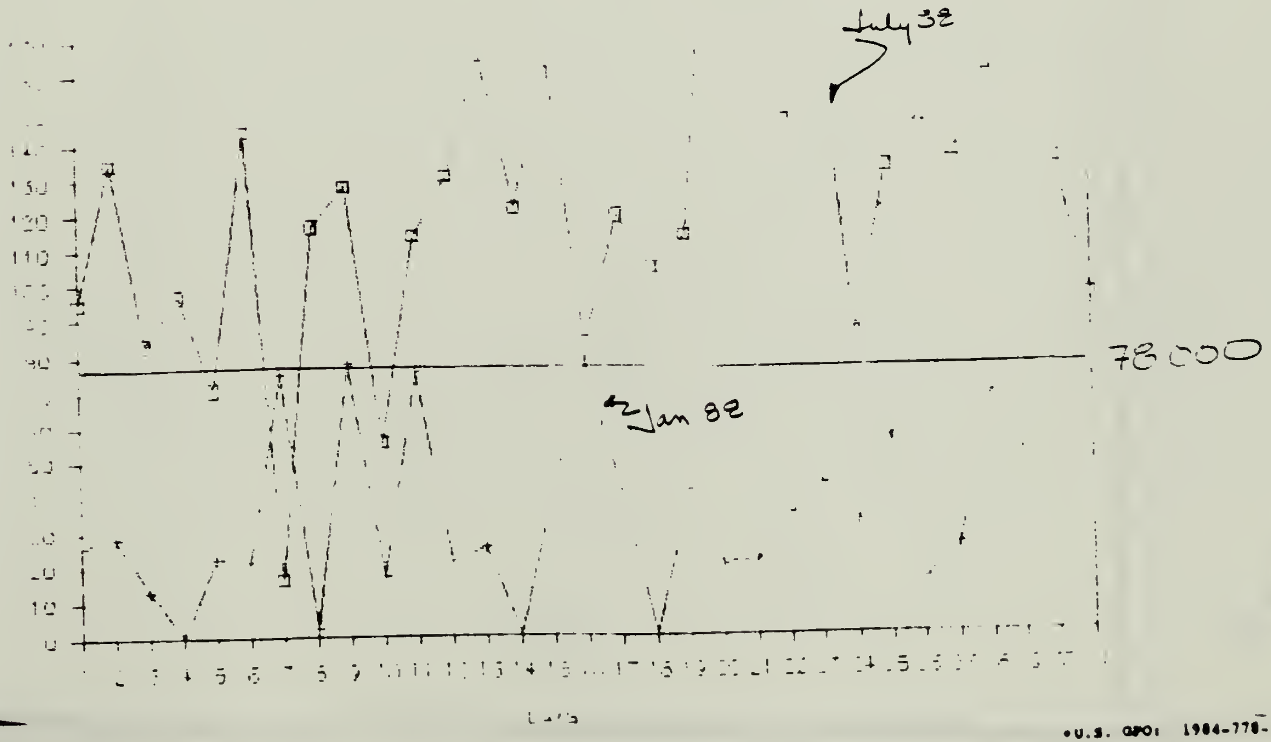
FORM D S C - 44

Park Lake Mead	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 2
Area Las Vegas Wash			**of** 8
Project	**By** DAP	**Checked**	**Pkg.** 5J2
Feature Irrigation	**Date** May 1989	**Date**	**Account**

$$\% \text{ Annual Irrigation} = \left(\frac{\text{Ann. Water Pumped} - \text{Ann. Wastewater Tx}}{\text{Ann water Pumped}}\right)100$$

$$\% \text{ used for irrigation} = \left(\frac{26.5\text{ MG} - 2.5\text{ MG}}{26.5\text{ MG}}\right)100$$

→ 91% water used for Irrigation



☆U.S. GPO: 1984-779-378

FORM D S C - 44

Park Lake Mead	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 3
Area Las Vegas Wash			**of** 8
Project	**By**	**Checked**	**Pkg.** 587
Feature Water Requirements	**Date** [illegible] 1989	**Date**	**Account**

Storage Requirements

Domestic: annual @ 91,000 gallons

Fire 1000 gpm @ 2hrs = 120,000 gallons

211,000 Gallons

Available Storage 100,000

Deficient Storage 111,000 Gallons

FORM DSC-44

Park Lake Mead NRA	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 4
Area Las Vegas Wash			**of** 18
Project	**By** DAC	**Checked**	**Pkg.** 583
Feature Pump Station Evaluation	**Date** Apr. 1 1989	**Date**	**Account**

Lift Station Capacity Evaluation:

$Q_{pump\,sta} = 57$ gpm (Measured by Park)

Estimated Flow:

$Q_{Ave} = 16{,}300$ gpd

Peak Factor = 4.0

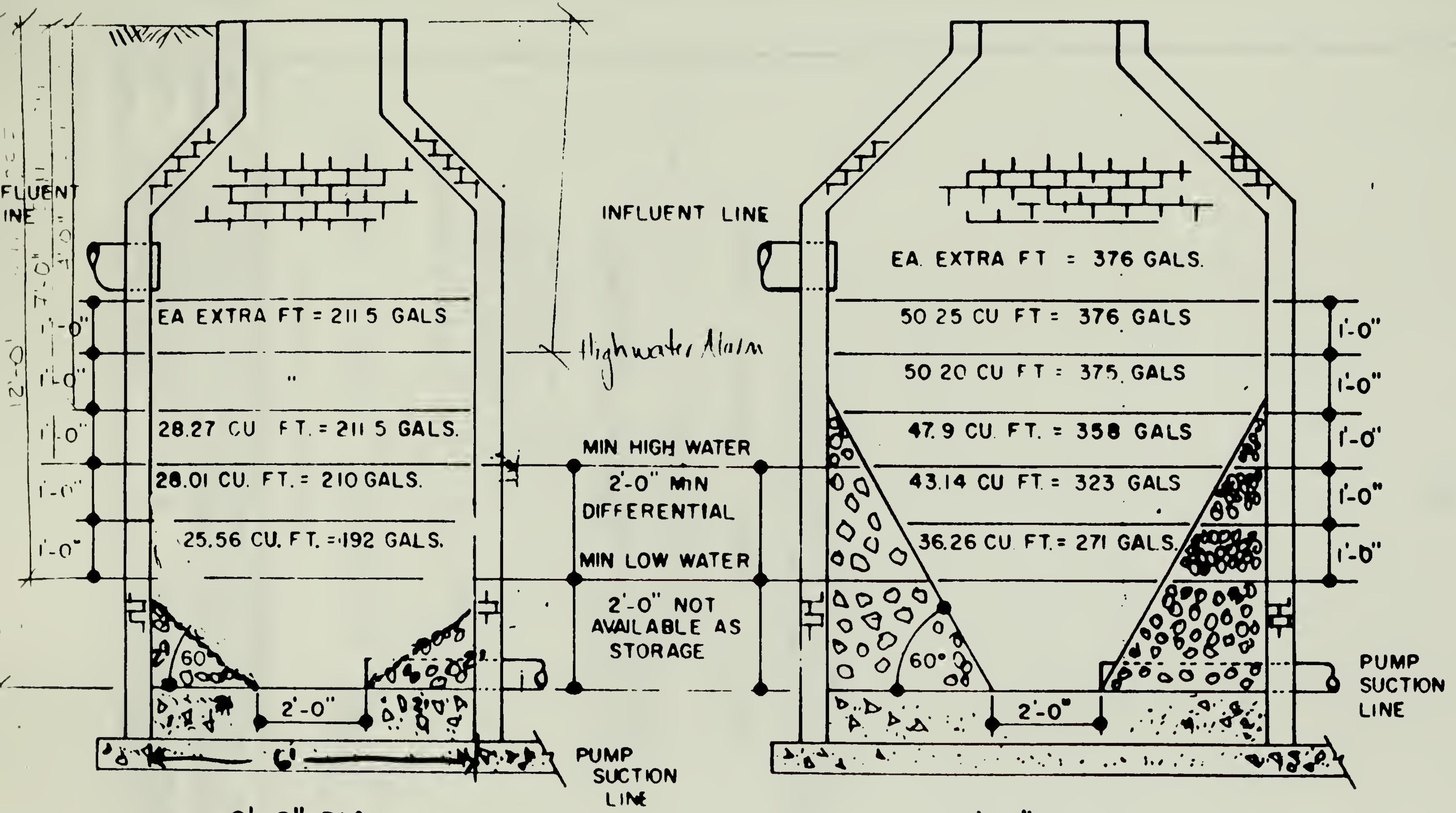
$Q_{peak} = 4(16{,}300 \text{ gpd}) = 65{,}200$ gpd

$= 45$ gpm

$Q_{pump\,sta} > Q_{peak}$: 57 gpm > 45 gpm

∴ Pump Station has adequate capacity to handle estimated peak flows.

*U.S. GPO: 1984-778-178



6'-0" DIA.

8'-0" DIA.

Wet Well Capacity: $(12-4)\times\pi(3)^2\times 7.48 = 1{,}692$ G

TYPICAL WET WELL DESIGNS

CAN-TEX INDUSTRIES, Process Equipment Division

FORM DSC-44

Park Lake Mead NRA	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 6
Area Las Vegas Wash			**of** 8
Project Lagoon Modification	**By** DAC	**Checked**	**Pkg.** 327
Feature Organic loadings	**Date** June 1989	**Date**	**Account**

Estimate BOD loading:

A. CURRENT SITUATION

Measure concentrations:

@ 3/16/89 : 74 mg/l

@ 4/20/89 : 95 mg/l

@ 6/16/89 : 334 mg/l

Average 168 mg/l

Estimate range of current loadings:

@ 3/16/89

$$BOD = (8.34)(74\,mg/l)(.003\,MGD) = 1.85\ \#/d$$

loading pond 2A: $\frac{1.85\ \#\ BOD/d}{.64\ A} = 2.89\ \#/A/D$

say $\frac{3\ \#\ BOD}{A-D}$

@ 4/20/89

$$BOD = (8.34)(70\,mg/l\ BOD)(.004\,MGD)$$

$$= 2.46\ \#\ BOD/d$$

loading pond 2B: $\frac{2.46\ \#\ BOD/d}{.33\ Acre} = \frac{7.5\ \#\ BOD}{A-D}$

say 8 # BOD/A-Day

FORM DSC-44

Park Lake Mead	NATIONAL PARK SERVICE DENVER SERVICE CENTER		Sheet
Area Las Vegas Wash			of
Project Lagoon Modification	By DAC	Checked	Pkg.
Feature ORGANIC LOADINGS	Date JUNE 1989	Date	Account

@June 16, 1989

BOD = (8.34)(334 mgl @ BOD)(.006 MGD)

= 16.7 # BOD

loading @ Pond 2B = $\frac{16.7 \text{ \# BOD/d}}{.33 \text{ Acre}}$ = 50.6 #BOD/A

say 51 #BOD/Acre

(exceeds Nevada's std lo

of 50 # BOD/A-D)

B. FUTURE SITUATION

1. Use BOD concentration of 200 mgl

current concentrations typically below 100 mgl; however increased loading through expansion of trailer village anticipated. Don't expect increase in loading from marina (say houseboat rentals) due to lake capacity levels established and anticipated growth elsewhere (Echo Bay, Callville Bay)

Average loading:

BOD = (8.34)(.0163 MGD)(200 mgl @ BOD)

= 27 lbs BOD

loading @ Pond 1A = $\frac{27 \text{ lb}}{.91 \text{ Acres}}$ = 29.6 $\frac{\text{\#BOD}}{\text{A-D}}$

loading @ Pond 2A = $\frac{27 \text{ lbs}}{.64 \text{ Acres}}$ = 42 $\frac{\text{\#BOD}}{\text{A-D}}$

Nevada's Regulations @ 50# BOD/A-D Maximum.
Both cells will meet this criteria.

FORM DSC-44

Park Lake Mead		**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 8
Area Las Vegas Wash				**of** 8
Project Lagoon Modification		**By** DAC	**Checked**	**Pkg.** 587
Feature Detention TIMES		**Date** June 1989	**Date**	**Account**

Calculate Detention time for annual average flow for design year:

$Q_{AVE} = 16{,}300$ gpd

$V_{1A} = 827{,}441$ gallons

$V_{2A} = 518{,}681$ gallons

Detention Time pond 1A = $\dfrac{827{,}441 \text{ Gallons}}{16{,}300 \text{ GPD}}$

= 51 days

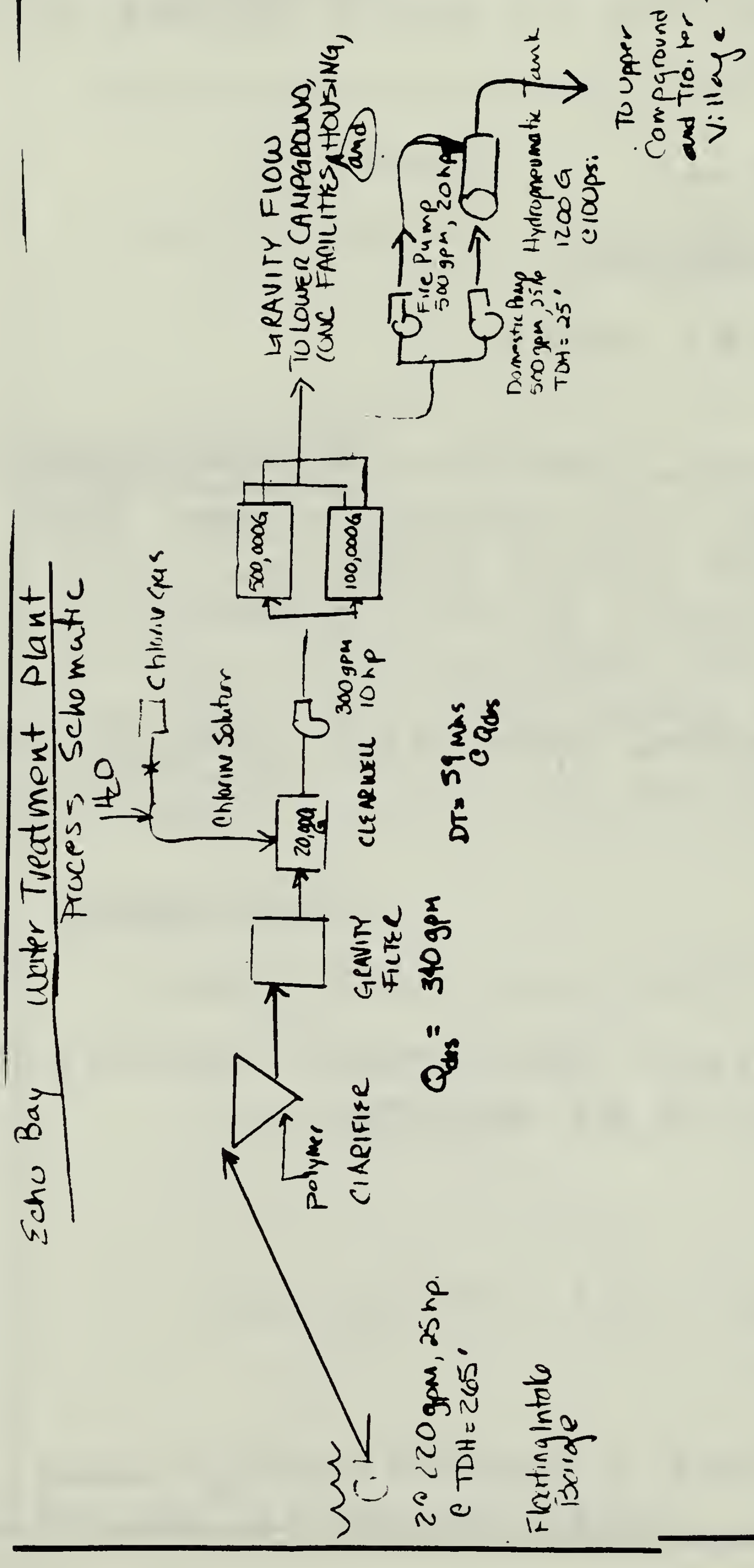
Detention Time pond 2A = $\dfrac{518{,}681 \text{ GALLONS}}{16{,}300 \text{ GPD}}$

= 32 DAYS

BOTH ACCEPTABLE. BOTH EXCEED NEVADA'S MINIMUM REQUIRED TIME OF 30 DAYS

FORM D S C - 44

Park Lake Mead	NATIONAL PARK SERVICE DENVER SERVICE CENTER		Sheet 1
Area Echo Bay			of 15
Project	By DAC	Checked	Pkg 537
Feature Process Schematic	Date May 89	Date	Account



Echo Bay Water Treatment Plant
Process Schematic
Floating Intake Barge
2 @ 220 gpm, 25 hp. @ TDH = 265'
Polymer
CLARIFIER
Q_des = 340 gpm
GRAVITY FILTER
20,000 G
CLEARWELL
DT = 59 mins @ Qdes
H2O
Chlorine Solution
Chlorine Gas
300 gpm 10 hp
500,000 G
100,000 G
GRAVITY FLOW TO LOWER CAMPGROUND, CONC FACILITIES, HOUSING, and
Fire Pump 500 gpm, 20 hp
Domestic Pump 500 gpm 35 hp TDH = 25'
Hydropneumatic Tank 1200 G @ 100 psi
To Upper Campground and Trailer Village

2/15

LAKE MEAD WATER AND SEWER STUDY
Package No. 587
WATER SYSTEM INFORMATION

OCATION Echo Bay DATE OF INSPECTION March 13, 1989
NSPECTED BY Sam Smith. D. Campbell

RAW WATER:
Source Lake Mead- Floating barge Intake Pump Capacity: 2 @ 220 gpm, [illegible]
Pump Mfg Peerless Serial No. 307940 and307941
Force Main Size ______ Length ______ Material ______
Storage Capacity None, pumped directly to clarifier
Chlorination System ______
Water Quality: Alkalinity ______ Hardness ______ Color ______
pH ______ Total Dissolved Solids ______ Turbidity ______
Comments Intake pumps installed in 1969. Little maintenance conducted
Barge badly needs repair.

TREATED WATER:
Clarifier 20'ϕ, 12'H
Filter 12'ϕ, 15'H
Design Capacity ~~300gpm~~ 340gpm @ 3gpm/sf 226gpm @ 2gpm/sf Ave. Mo Demand ______ Peak Mo Demand ______
D.O.I. 1967 Mfg ______ Clearwell 21'ϕ, 8'H
Clarifier 2'6" overflow weir (submerged by both intake pumps). Mixer not operational Filter Type Permujet Gravity Filter Depth ______
Clear well Storage 20,000 G (21 Dia.) Storage Pumps 2 @ 200gpm, 265TDH 25hp.
Mfg ~~Floway JKM~~ Peerless Serial No. 646095-1 and 2
Treated Water Storage Capacity 1956 - 33'X16' 100,000 G ( ) and 500,000 G (73 Dia.)

Comments Exterior storage tanks last painted in 1982. No prechlorination.
Both treatment plant pump station and pneumatic pump station need structural repairs. Black Walls cracking, roofs in bad shape.

DISTRIBUTION SYSTEM:
Pipe Size 2/4/6 inches Length 4,800/1,800/7.400

5.5'ϕ, 21.5'L - 3920

Hydropneumatic Tank Adavance Welding . serial no 14891. 1200 G capacity to serve upper campground and trailer village. Compressor Newmar [illegible]
Pumps 2. Starite 500 gpm, 25 TDH Comments Pumps too large. must trottle or tank easily overfilled.

Fire Pump Peerless Pump. 500 gpm @ 41 psi Fire Pump Motor U.S. Electric 20 hp. serial no. 3582437 Comments Capacity limited for current service area.

Comments ______

ENERAL COMMENTS:
______

FORM D S C - 44

Park Lake Mead	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 2
Area Echo Bay			**of** 15
Project	**By** DAC	**Checked**	**Pkg.** 587
Feature Water Capabilities	**Date** May 1989	**Date**	**Account**

from Park Records – current water use

Q_{ave} = 147,400 gpd (102 gpm)

Q_{pk} = 255,000 gpd (176 gpm)

Q_{design} · based on mfgr information 12'Φ Filter

Q @ 3 gpm/sF = 340 gpm

Clarifier: 20'Φ
12' high

ave overflow rate = 147,400 gpd / 2.5 = 58,960

pk overflow rate = 255,000 gpd / 2.5'π = 102,000

Acceptable overflow @ 20,000 gpd/LF
∴ both conditions exceed!

DETENTION TIME

$Q_{ave} = \frac{28,198\ G}{220\ gpm}$ = 128 mins = 2.1 hrs.

$Q_{pk} = \frac{28,198\ G}{440\ gpm}$ = 64 mins = 1.1 hrs

Contact time

Clearwell = 21'Φ x 8' high = 20,726 G

$DT = \frac{V_{cw}}{Q_{cp}}$ $\frac{20,726\ G}{200\ GPM}$ = 103 mins = 1.7 hrs

FORM D S C - 44

Park Lake Mead	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**	**Sheet** 9
Area Echo Bay		**of** 15
Project	**By** DAC / **Checked**	**Pkg.** 587
Feature Water Tx	**Date** May 1989 / **Date**	**Account**

① Future Water Requirements

Q_{Ave} = 147,400 (1.15) = 169,510 gpd

Q_{PK} = 255,000 (1.15) = 293,250 gpd

Minimum Storage Requirements

Domestic (24 Q_{Ave}) = 169,500 GAL

FIRE

1000GPM @ 2HR 120,000

289,500

$V_{Available}$ = 600,000 G > 289,500 G ($V_{Req'd}$)

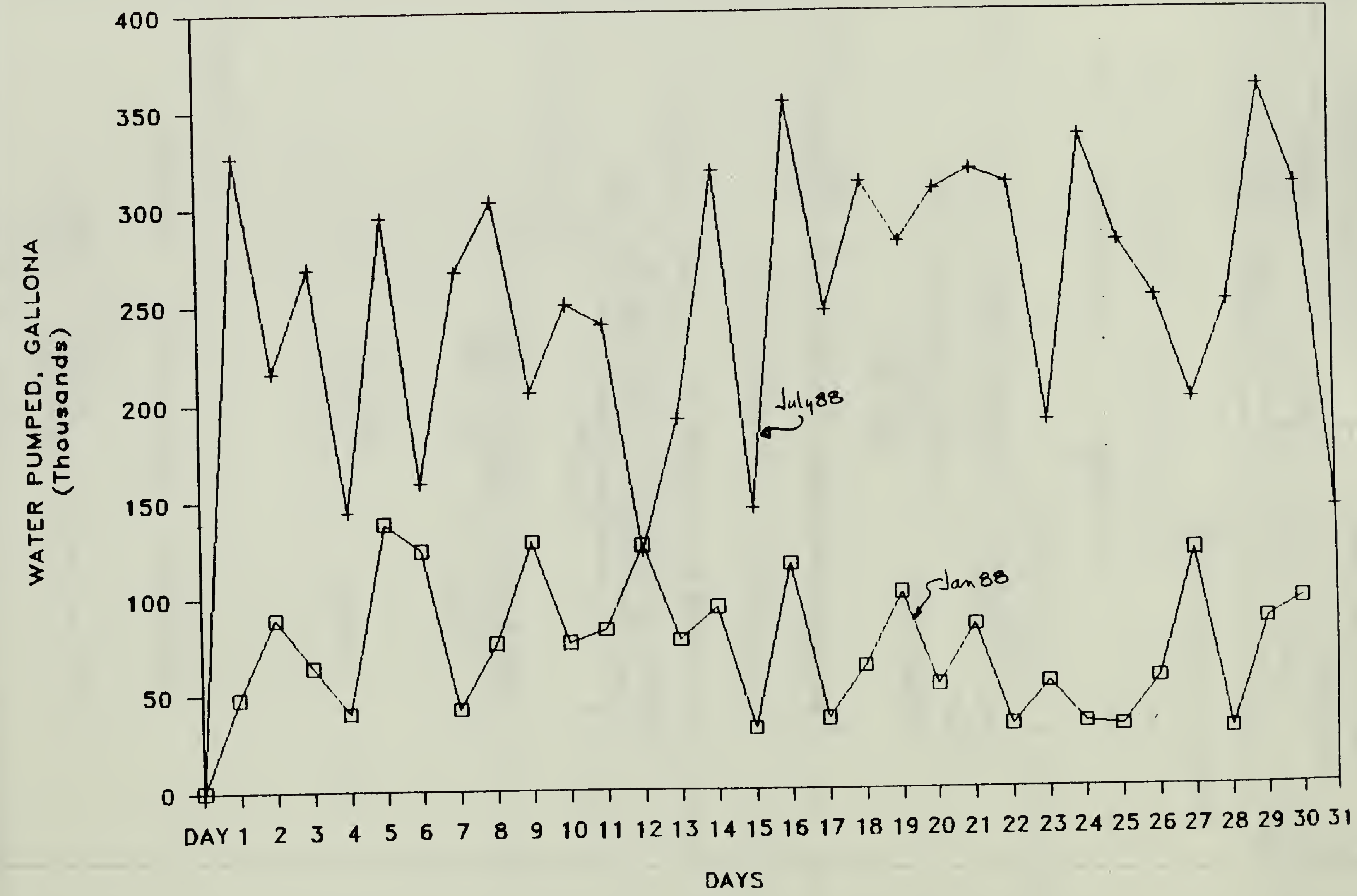
Est % water used for irrigation

$$\% = \left(\frac{\text{Ann Water Pumped} - \text{Ann WW Tx}}{\text{Ann Wat}}\right)100$$

$$= \left(\frac{53.8 - 9.1}{53.8}\right)(100) = \underline{83\%}$$

ECHO BAY WATER USUAGE

HIGH AND LOW MONTHLY USE



140,00

FORM D S C - 44

Park Lake Mead NRA Area Echo Bay	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**	Sheet 6 of 15
Project	By WTC	Checked	Pkg 582
Feature Evaluate Hydropneumatic Tank	Date May 1989	Date	Account

Hydropneumatic Tank

Arc Welding (#1489)

5½' φ × 22' long

V = 3,909 Gallons

Service Area Design Q

109 Trailers × 3 PE/trailer × 75 GPD/PE = 24,525 gpd

66 campsites × 3.3 PE/S.C × 35 gpcd = 7,623 gpd

32,148 gpd

Q_{Ave} = 22 gpm or 1400 gph

Q_{PK} = 88 gpm or 5,600 gph

Tank Capacity

– assume 40% Volume released; 4x per hour to maintain pressure

$$= 3909 \text{ Gallons } (.4) \times \frac{4 \text{ times}}{\text{hr}} = \underline{6,254} \text{ gph}$$

Delivered Q_{PK} slightly higher than Q_{PK} estimated –

7/15

Opend .082
OA = 25/

LAKE MEAD WATER AND SEWER STUDY
Package No. 587

Wastewater System

AREA Echo Bay Date of Inspection March 13, 1989

COLLECTION:

Pipe Size _______________ Length _______________ Materials _______________
Pipe Size _______________ Length _______________ Materials _______________
Pipe Size _______________ Length _______________ Materials _______________
Pipe Size _______________ Length _______________ Materials _______________

Lift Station No. 1 Location Marina Type Dry pit - Wet Well
Mfgr. Smith & Loveless I.D. No. S- 077162 D.O.I. 1967
Pump Capacity 2 @ 100 gpm @ 99 ' TDH
Pump Mfgr. Econdyne (No. 730654107) Metering none Motor Mfgr. Gener
Electric (15hp) Wet Well Capacity ~~387~~ G 220 G Pump Frequency ________

Lift Station No. 2 Location Isolated wash, near water plant Type Dr. Pi
Mfgr. Smith & Loveless I.D. No. C74230 D.O.I. 1967
Pumps Capacity 2 @ 100 gpm @79TDH Pump Mfgr. Econdyne 4B2A
Motor Size 15 hp, General Electric Pump Frequency

Lift Station No. 3 Location near trailer park Type Dry pit - Wet We
Mfgr. Smith & Loveless I.D. No. C77163 D.O.I. 1967
Pump Capacity 100 gpm @ 99' TDH Pump Mfg. Econdyne 4B2A
Metering Total pump run time Motor General Electric, 15 hp
Pump Frequency ______________________ wet well = 387G

Comments Stations run continuously. All are at or above rated capacity
Staff has noted that the pumps run for hours during peak usuage (holidays
All wires extremely corroded.

TREATMENT:

TYPE Evaporative stabilization ponds D.O.I. 1967 Ave Mo.Flow ______

Pond No. 1 Size 1.6 Acres 289 x 194 Aeration 4, 1 hp aero type Normal Operati
Depth 4 feet Liner Material Hypalon overlying geofabric Condition
fair

Pond No. 2b Size 1.2 Acres 244 x 194 Type nonaerated
Normal Operating Depth 4 feet Liner Material Hypalon overlying geofab
Condition fair

Pond No. 2a Size .47 95 x 194 Type nonaerated Normal Operating Depth 4 fe
Frequency of Operation _______________
Liner Material hypalon

Pond 3 & 4 @ 1.6 Acres/each

GENERAL: Additional acres of lagoon outside exisiting fenced area. cou
be expanded for future use. No emergency power on site. Generators obtain
from headquaters if required. Gravity lines have plugged in area of upper
campground - trailer park. Need to reroute certain sewers

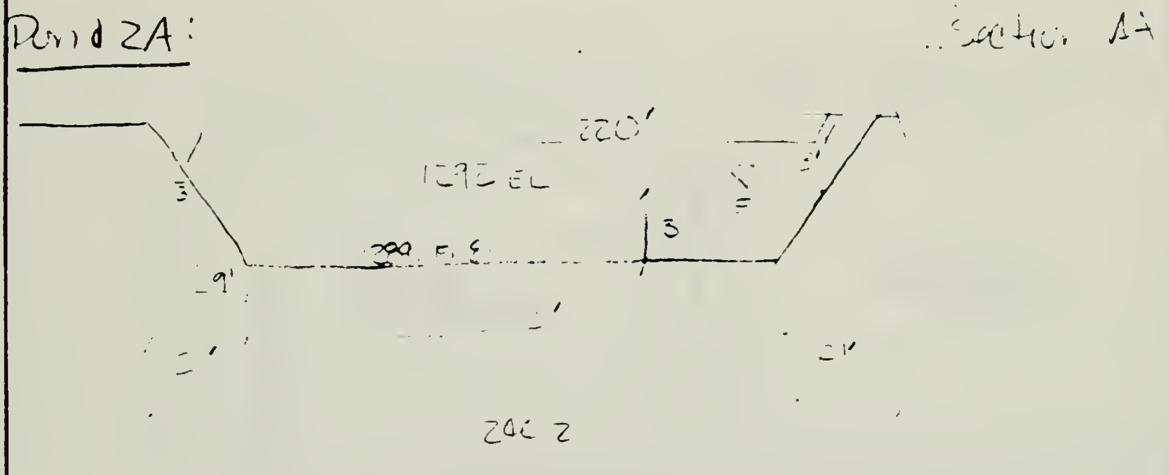
EB:SDS before 1966 used septic tank. (170' x 77'. leach fi)

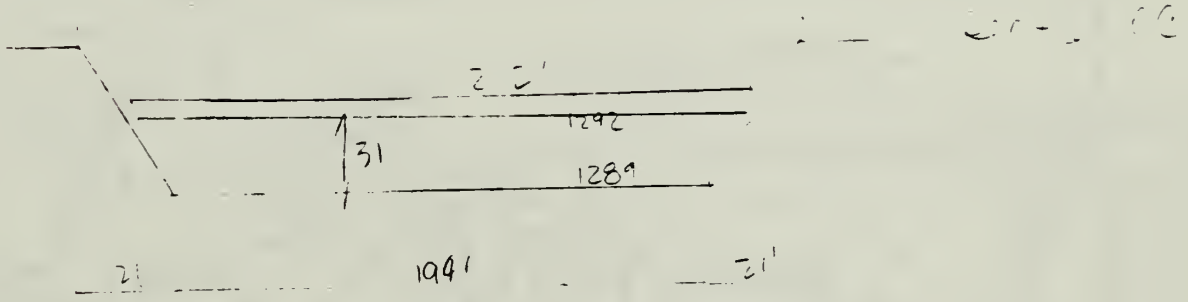
FORM D S C - 44

Park Lake Mead NRA	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**	Sheet 8
Area [illegible]		of 13
Project	By [illegible] / Checked	Pkg 537
Feature Sewage lagoon	Date Jan 85 / Date	Account

Calculate surface area and volume of modified lagoons 2A and 2B:

Pond 2A:





Surface area = (212')(220') = 46,640 sq ft = 1.07 ac

$$V = \left[(L\cdot W) + (L-2sd)(W-2sd) + 4(L-sd)(W-sd)\right]\frac{d}{6}$$

$$V_{2A} = \left[(220\cdot 212) + (220-2(3)(3) + 4(220-3(3)(212-3(3)\right]\frac{3}{6}$$

$$\left[46640 + 202 + 844(203)\right]$$

$V = 218,174\ f^3 = 1.632\ MG$

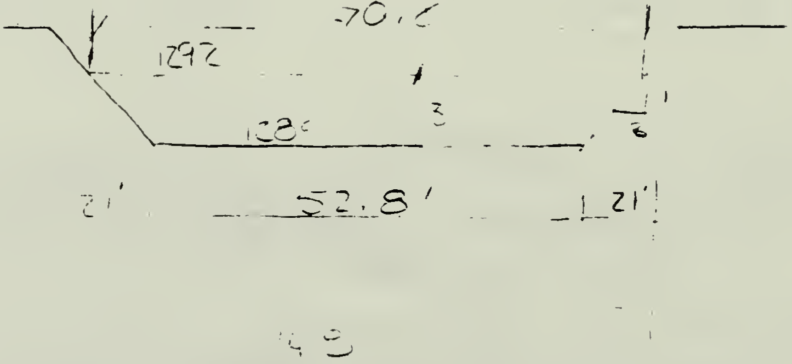
•U.S. GPO: 1984-778-378

FORM D S C - 44

Park Lake Mead NRA	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		Sheet 2
Area Echo Bay			of 13
Project	By DTC	Checked	Pkg. 58
Feature Sewage Lagoon	Date JAN 89	Date	Account

Pond 2B - Calculate surface area · volume @ 3' depth

Section 2B



Length - Same as pond 2A

Surface area - (70.8')(212') = 15,010 sf = .34 A

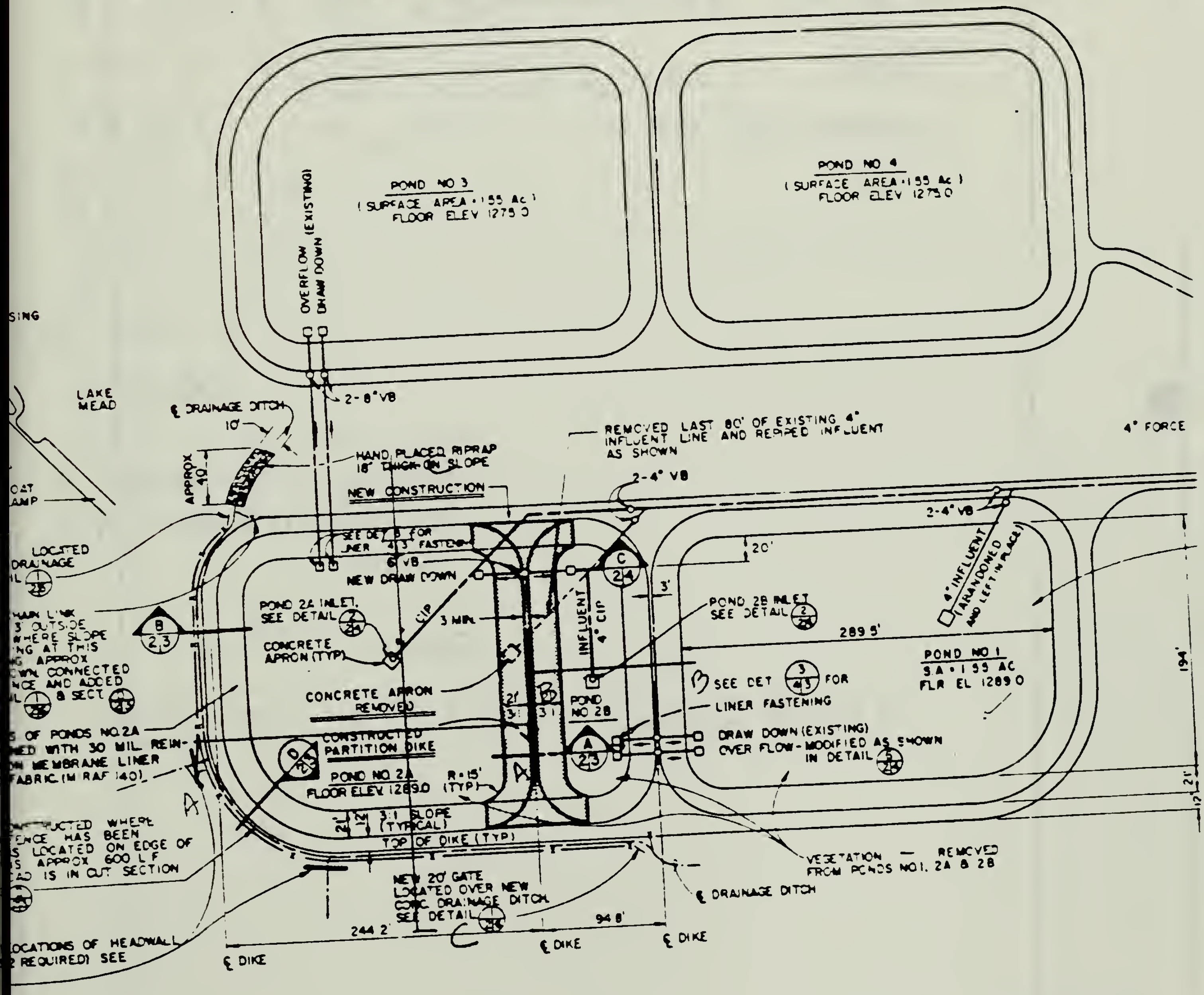
$$V = \left[(L \times W) + (L-2sd)(W-2sd) + 4(L-sd)(W-sd)\right]\frac{d}{6}$$

$$V = \left[212(70.8) + [212 - 2(3)(3)][70.8 - 2(3)(3)] + 4(212 - 3(3))(70.8 - 3 \cdot 3\right.$$

$$= \left[15,009 + 10,243 + 50,181\right]3/6$$

$$= 37717\ f^3 = 282,121\ \text{Gallons}$$

10/15


POND NO 3
(SURFACE AREA • 1.55 Ac)
FLOOR ELEV 1275.0
OVERFLOW
DRAW DOWN (EXISTING)
POND NO 4
(SURFACE AREA • 1.55 Ac)
FLOOR ELEV 1275.0
SING
LAKE MEAD
℄ DRAINAGE DITCH
10'
2-8" VB
APPROX 40'
HAND PLACED RIPRAP 18" THICK ON SLOPE
OAT AMP
NEW CONSTRUCTION
REMOVED LAST 80' OF EXISTING 4" INFLUENT LINE AND REPIPED INFLUENT AS SHOWN
2-4" VB
4" FORCE
2-4" VB
LOCATED DRAINAGE IL 1/2B
SEE DET 3 FOR LINER 4/3 FASTENING
6" VB
NEW DRAW DOWN
C 2/4
20'
4" INFLUENT (ABANDONED AND LEFT IN PLACE)
HAIN LINK 3' OUTSIDE WHERE SLOPE NG AT THIS G APPROX WN CONNECTED NCE AND ADDED IL 1/2B & SECT 2/3
B 2/3
POND 2A INLET, SEE DETAIL 2/2A
CIP
3 MIN
INFLUENT 4" CIP
3'
POND 2B INLET SEE DETAIL 2/2B
289.5'
CONCRETE APRON (TYP)
POND NO 1
S.A • 1.55 AC
FLR EL 1289.0
194'
CONCRETE APRON REMOVED
B SEE DET 3/43 FOR LINER FASTENING
S OF PONDS NO. 2A NED WITH 30 MIL REIN- ON MEMBRANE LINER FABRIC (M RAF 140)
21 3:1
3:1
POND NO 2B
CONSTRUCTED PARTITION DIKE
A 2/3
DRAW DOWN (EXISTING)
OVER FLOW - MODIFIED AS SHOWN IN DETAIL 5/2B
D 2/3
POND NO 2A
FLOOR ELEV 1289.0
R • 15' (TYP)
A
A
21'
12'
3:1 SLOPE (TYPICAL)
TOP OF DIKE (TYP)
CONSTRUCTED WHERE FENCE HAS BEEN S LOCATED ON EDGE OF S APPROX 600 L.F AD IS IN CUT SECTION
VEGETATION — REMOVED FROM PONDS NO 1, 2A & 2B
NEW 20' GATE LOCATED OVER NEW CONC. DRAINAGE DITCH SEE DETAIL 1/2B
℄ DRAINAGE DITCH
C
244.2'
94.8'
LOCATIONS OF HEADWALL 2 REQUIRED) SEE
℄ DIKE
℄ DIKE
℄ DIKE

PLAN OF EXISTING SEWAGE LAGOON & MODIFICATIONS

SCALE 60 0 60 120 FT

—— EXISTING CONSTRUCTION

—— NEW CONSTRUCTION

VB —— GATE VALVE IN CAST IRON BOX (CAST IRON PIPE)

---- —— OBLITERATED

FORM D S C - 44

Park Lake Mead	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 11
Area Echo Bay			**of** 15
Project	**By** DAC	**Checked**	**Pkg.** 587
Feature Capacity of Lift Stations	**Date** May 1989	**Date**	**Account**

Lift station 1 & 2 (Same flow)

campground: 100 sites × 3.3 PE/site × 35 gpcd = 11,550 gpd

motel 52 units × 50 gpcd × 2 c/unit 5,200 gpd

Restaurant 168 seats × 5 gpc/seat = 840 gpd

Staff [illegible] units × 4 [illegible] × 75 gpcd = [illegible],100 gpd

Day Use [illegible] [illegible]

21,960 gpd

(16 gpm)

→ Peaking Factor @ 8 due to proximity of development to Lift station & proximity to Lake.

Qpeak = 128 gpm

→ Estimate Qfuture @ 1.15(128) = 147 gpm; say 150 gpm

FORM D S C - 44

Park Lake Mead NRA	NATIONAL PARK SERVICE DENVER SERVICE CENTER		Sheet 12
Area Echo Bay			of 15
Project	By DC	Checked	Pkg. 557
Feature	Date March 1989	Date	Account

Lift station 3 (upper lift station)

Q - from lower lift station 16 gpm

Q - from upper campground & trailer village (all hydropneumatic cases) 22 gpm

QA = 38 gpm

Qpk = [illegible] gpm = 15[illegible]

•U.S. GPO: 1984-778-378

FORM D S C - 44

Park Lame	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 13
Area E[illegible] Bay			**of** 15
Project	**By** [illegible]	**Checked**	**Pkg.** 537
Feature [illegible]	**Date** Nov 1989	**Date**	**Account**

From the record - current Q

Q_{ave} = 25,000 gpd

$Q_{pk\,Mo}$ = 36,000 gpd

BOD - samples from final L.S wet well obtained quarterly
range of samples concentration: 150 - 770 mg/l BOD_5

Average: 460 mg/l

Pond Area

inside Fence	#1	lined / aerated	1.2 acres
	#2	lined / aerated	.5 Acres
	#3	unlined	1.6 Acres
			3.2 Acres
Outside Fence			
	#4	unlined	1.2 Acres
	#5	unlined	1.2 Acres
			2.4 Acres

Detention Time
Present

Pond 1: $209{,}100\,f^3 \times 7.48\,G/f^3 \times D/36{,}000 =$ 43 days

Pond 2: $156{,}800\,f^3 \times 7.48\,/f^3 \times D/36{,}000 =$ 32 days

Both > than NDEP required minimum
detention time of 30 days

FORM D S C - 44

Park Lame	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**	Sheet 14
Area Echo Bay		of 158
Project	By DM / Checked	Pkg. 587
Feature Wastewater Facilities	Date May 89 / Date	Account

Organic loading = Q[BOD] 8.34 / Area

Pond 1 = (320 mg/l) (.036) (8.34) /1.2 = 80 #/A

Pond 2 = (320 mg/l) (.036) (8.34) /.5 = 193 #/A

maximum loading = 178 # BOD/Ac

∴ organic load on Pond 1 acceptable, organic load on Pond 2 unacceptable

Future [illegible]

Q_A = .025(1.15) = .028

$Q_{PK\,MO}$ = .036(1.15) = .041

DETENTION TIMES

Pond 1 = 209,100 ft³ (7.48 / ft³)(D/41,000) = 38 days

Pond 2 = 156,800 ft³ (7.48/ft³)(D/41,000 = 29 days
(Short 1 day!)

ORGANIC LOADS

POND 1 : (320 mg/l)(8.34)(.041) / 1.2 Ac = 91 #/A

POND 2 : (320 mg/l)(8.34)(.041 MGD) / 0.5 Ac) = 218 #/A

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FORM D S C - 44

Park LAME	NATIONAL PARK SERVICE DENVER SERVICE CENTER		Sheet 15
Area Echo Bay			of 15
Project	By DAE	Checked	Pkg. 53
Feature Sewage Treatment & Disposal	Date May 1989	Date	Account

Area of Lagoons Required for future Flows

$$A_{reqd} = \frac{Q_{AN\,AVE}}{\text{depth} - [PPT - Evap - Seep]}$$

$$= \frac{2{,}000{,}068 \text{ FT}}{3 - [53' - 696' - 2]} = \underline{\underline{4.0 \text{ Acres}}}$$

Area Available (5.6 Acres) > Area Required (4.0 Acres)

FORM D S C - 44

Park Lake Mead NRA	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		Sheet
Area Overton Beach			of 5
Project	By DAC	Checked	Pkg. 53+
Feature wastewater Evaluation	Date June 1989	Date	Account

wastewater Flows (from Park Records)

QA = 7,700 gpd

QpK Mo = 12,000 gpd

QDesign = 41,059

Pond

1	.34	lined / operated w/ 7½ hp
2	.30	lined
3	.34	unlined
	1.1 Acres	

Influent BOD 174 mg/l - 521 mg/l (ave=410 mg/l)

Detention time = 553,916 G / 2,000 GPD = 46 Days

ORGANIC LOADING = (8.34) (410 mg/l)/.34 (.012 MGD) = 121 lb BOD/Acre

Future Flows QA = 7,700 (1.15) = 8,855 gpd

QPK = 12,000 (1.15) = 13,800 gpd

Area Required = 673,400 G / Ξ - (.53' - 696' - 2) = 56,191 ft² = 1.1

Amt Available ≈ Amt Required

Will not recommend expansion

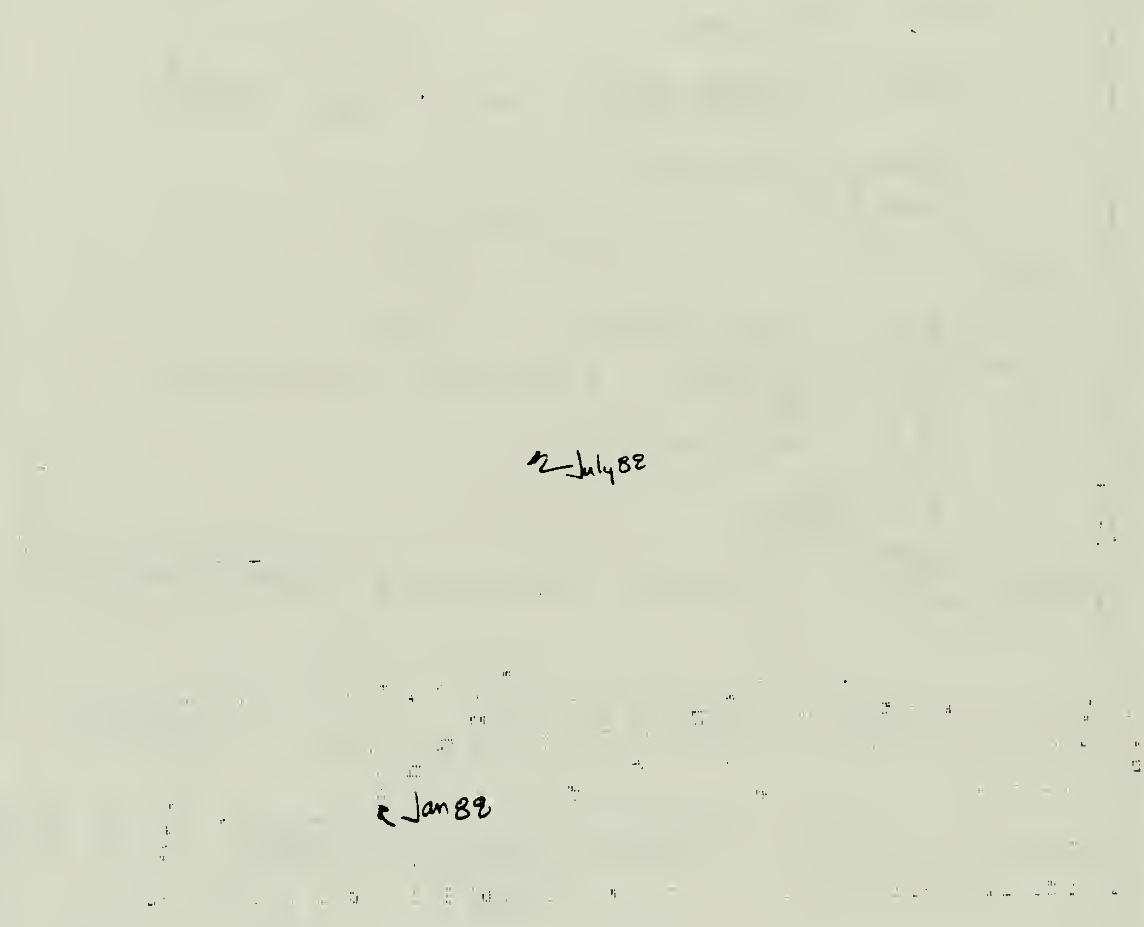
Due to slow growth @ Overton —

However addition land has been set aside

[illegible]

FORM D S C - 44

Park Lake Mead	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		Sheet 2
Area [illegible]			of 5
Project	By [illegible]	Checked	Pkg. 38
Feature	Date May 89	Date	Account



FROM RECORDS

Ave Day - non irrigation season = 27,000 gpd

Check major holiday weekends & daily demands is:

Memorial Day 29,000
4th July 29,800
Labor Day 22,300

Qpk 27,033 gpd

Don't see much difference btw Qp (which [illegible] w/o irrigation) and annual average - Possibly due to small growth & little veg [illegible]

FORM D S C - 44

Park Lake Mead NRA	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 5
Area Overton Beach			**of** 5
Project	**By**	**Checked**	**Pkg.** 5X2
Feature Sewage TV 3D1500SW	**Date** June 1989	**Date**	**Account**

Future DT = 553,910 G / 13,200 GPD = 40 Days

organic load = 8.34(.0138)(410) / .34 = 138# BOD/Acre

O₂ Required

O_2 reqd = 1.5 x Peak BOD

= 1.5 (8.34)(410)(.0138) = 70# O_2 / Day

= 3 # O_2/hr

O_2 available

$$N = N_a / \alpha \left(\frac{C_{sw} - C_L}{C_s}\right) 1.025^{T_w - 20}$$

$$= \frac{5.9 \#O_2/hr}{.9\left(\frac{6.8-2}{9.17}\right)(1.025)^{28-20}} = 10.3 \frac{lbO_2}{hr}$$

O_2 available > O_2 required

Check Hp Requirements:

$$10.3 \frac{lbO_2}{hr} \times \frac{hp\,hr}{3.12\,lbO_2} = 3.3\,hp$$

hp available = 7½ hp > hp. required

*U.S. GPO: 1984-778-378

FORM D S C - 44

Park Lake Mead NRA	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 4	
Area Overton Beach			**of** 5	
Project	**By** DAC	**Checked**	**Pkg.** 587	
Feature Water Treatment	**Date** May 1984	**Date**	**Account**	

FROM ANNUAL WATER USE

Present

Q_A = 15,000 gpd (12 gpm)

Q_{PK} = 50,900 gpd (40 gpm)

Future

Q_A = 1.15 (15000) = 17,250

Q_P = 1.15 (50900) = 58,500

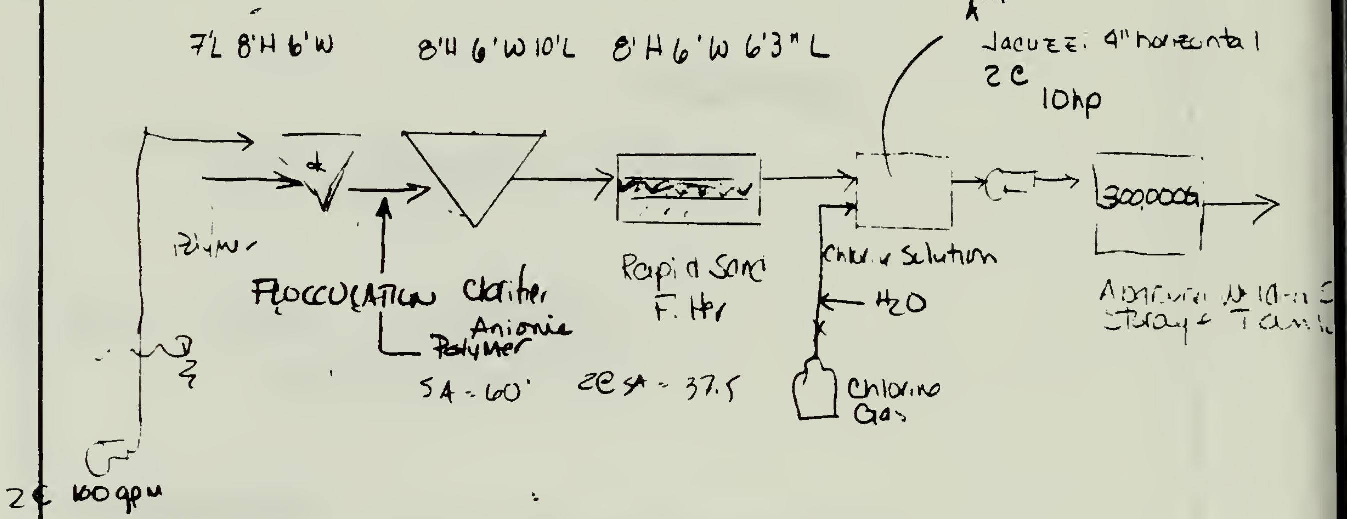
Film Pump Capacity @ 100 gpm – okay

TV plant capacity @ 150 gpm – okay (oversized?)

Overton Beach Water Treatment Plant

Process Schematic

(No Scale)



overflow rate: $\frac{100\text{ gpm }(1440)}{10'} = 14,400$ gpd/LF < 20,000 gpd/LF

okay

Filtration Rate = 100 GPM / 37.5 SQFT = 2.7 gpm/sf

< 3 gpm

FORM D S C - 44

Park Lake Mead NRA	NATIONAL PARK SERVICE DENVER SERVICE CENTER		Sheet 5
Area Overton Beach			of 5
Project	By DAE	Checked	Pkg. 387
Feature Water Storage Requirements	Date March 1989	Date	Account

water storage available = 300,000 G

Water Storage Requirements:

Min Domestic = 24hr. Average 17,250 gallons

Min Fire = 2hrs From @ 1000 gpm 120,000 gallons

137,250 GAllons

Volume Available >> Volume Required

*U.S. GPO: 1984-778-378

FORM D S C - 44

Park lome	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		Sheet 1
Area Cottonwood Cove			of 7
Project	By TJ	Checked	Pkg. 58
Feature Est Pump capacity	Date May 89	Date	Account

	JAN 88	MARCH 88	MAY 88	JULY 88
lodge	9	29	64	77
Trailer	182	201	438	384
[illegible]	[illegible]	139	123	96
[illegible]	[illegible]	16	105	105
[illegible]	1	3	5	5
[illegible]	50	50	50	50
[illegible]	314	[illegible]	690	562
[illegible] gpcd	423	275	304	424

current

Q_{ave} = 246,000 gpd = 170 gpm

Q_{pk} = 388,600 gpd = 270 gpm

Future – est 15% growth

Q_A = 1.15(170 gpm) = 196 gpm

Q_{pk} = 1.15(270 gpm) = 310 gpm

Pumping Capacity = 1° well = 350 gpm

2° well = 500 gpm

Qcapacity > Q estimate domestic demand

∴ No additional pumping capacity required

FORM D S C - 44

Park Lake Mead NRA	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 2
Area Cottonwood [illegible]			**of** 7
Project	**By** DAC	**Checked**	**Pkg.** 587
Feature Water Treatment & Storage	**Date** M. 1939	**Date**	**Account**

Storage Available.

25,000 G (Abandoned)

#1 100,000 G (DOI - 1961)

#2 200,000 G (DOI - 1967)

300,000 G

Storage Required:

Domestic: 24 hr annual average 282,900 G

Fire : 2 hr @ 1000 gpm 120,000 G

402,900 G

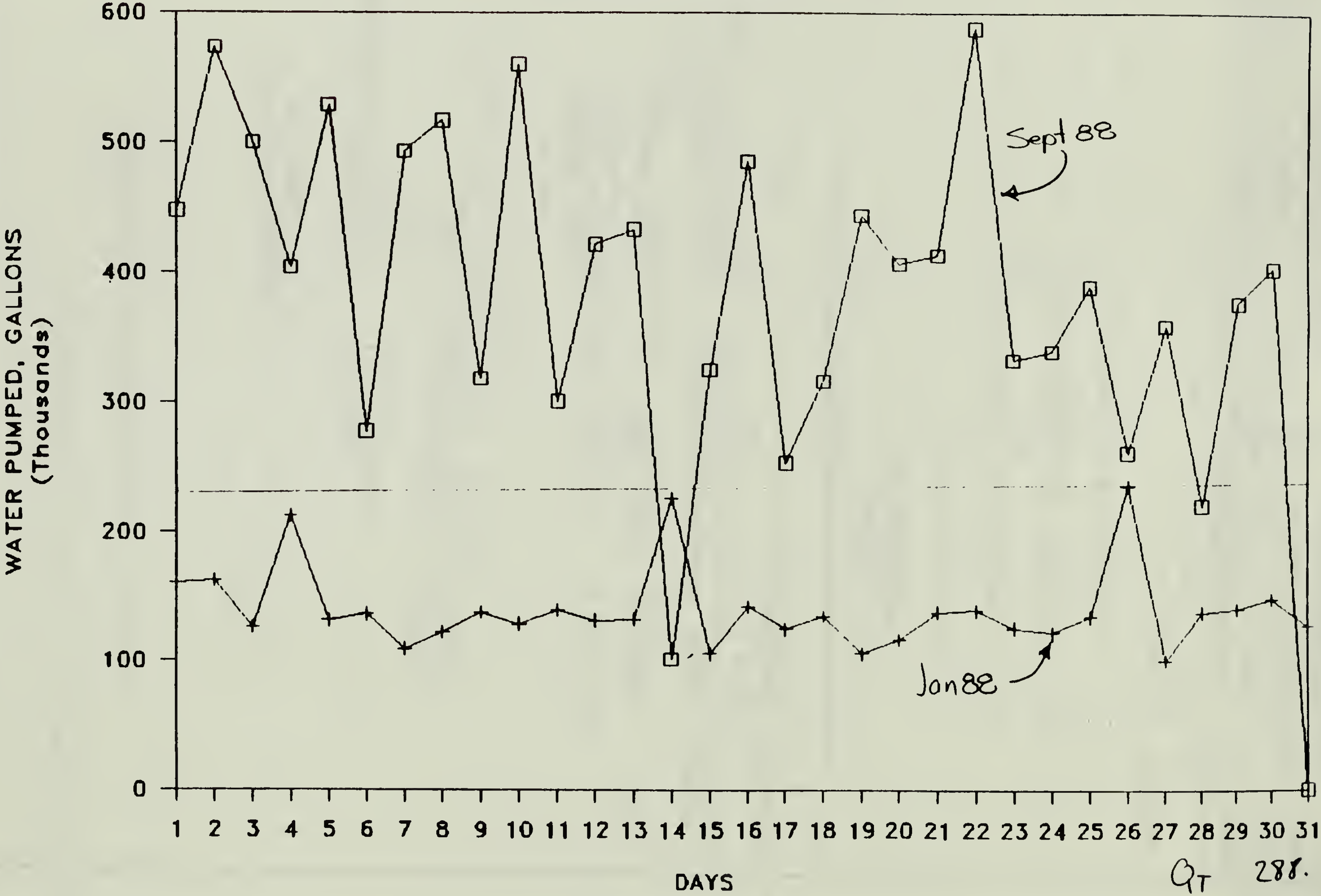
Volume Available < Volume Required

Deficit = 402,900 - 300,000

= 102,900 G

COTTONWOOD COVE WATER USUAGE

HIGH AND LOW MONTHLY USE



Q_T 288.

Q_{Home} = 80.3

4/-

LAKE MEAD WATER AND SEWER STUDY
Package No. 587

Wastewater System

[illegible] Cottonwood Cove Date of Inspection [illegible]
[illegible]LLECTION:

Pipe Size ______ Length ______ Materials ______
Pipe Size ______ Length ______ Materials ______
Pipe Size ______ Length ______ Materials ______
Pipe Size ______ Length ______ Materials ______

Lift Station No. 1 Location Marina Parking Type [illegible]
Model [illegible] 504D-1 Mfgr [illegible] D.O.I.
[illegible] Fairbanks [illegible]

[illegible]
Type Dry pit - wet well [illegible]
Mfgr. Cante D.O.I.
Pump Capacity Two Fairbanks-Morse [illegible] 22 gpm, 123 [illegible]

TREATMENT:
Two Stabilization Lagoons [illegible] Design [illegible]

(315'x440')
Pond No. 1 Size 3.5 Acres Type Primary Aeration none
Normal Operating Depth Presently not in operation Liner Material Hypal
Condition Poor

(240'x560')
Pond No. 2 Size 2.5 Acres Type Primary Pond Aeration 3 @ 2 hp
Normal Operating Depth 4 feet Liner Material Hypalon Condition Fair
(500'x195')
Pond No. 3 Size 1.5 Acres Type Percolation Aeration None
Normal Operating Depth 0-2 feet Liner Material Bentonite
Condition good

Δ @ 500'x195'

GENERAL: Odor problems occur annually during spring over turn. The Park receives numerous complaints at that time due to [illegible] winds and locatio[illegible] of trailers. The situation might be alleviated by reducing the amount of [illegible] for aerated primary treatment.
[illegible]

FORM D S C - 44

Park Lake Mead NRA	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 5
Area Cottonwood Cove			**of** 7
Project	**By** DAC	**Checked**	**Pkg.** 58
Feature Wastewater Ty	**Date** May 1989	**Date**	**Account**

LOWER LIFT STATION CAPACITY

EST Q DAY USE: 290PE x 10 gpd/PE 2,900
MOTEL: 24 units @ 50 GPD/UNIT x 3PE/unit 3,600
RESTAURANT: 20 seats x 10 gpd x 10 2,000
Trailer: 200 units @ 75 gpd/c x 2 PE/unit (.50) 15,000

23,500 gpd
(16 gpm)

Peaking Factor (8) ⇒ Q_{Pk} = 130 gpm

$Q_{station}$ = 195 gpm > Q_{pk}

UPPER LIFT STATION

Q lower station 23,500

Upper Facilities
7 houses x 75 gpd/house x 3PE 1,575

Campgrounds
149 sites x 25 gpcd x 2 PE/site (50%) 3725

28,800 gpd say 29,000
= 20 gpm

Peaking Factor = 8

Qpeak = (8)(20 gpm) = 160 gpm

FORM D S C - 44

Park Lake Mead NRA	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**	**Sheet** 6
Area Cottonwood Cove		**of** 7
Project	**By** DAC / **Checked**	**Pkg.** 377
Feature SEWAGE TX & DISPOSAL	**Date** May 1986 / **Date**	**Account**

Flow Records - current

$Q_{Ave} = 29{,}500$ gpd

$Q_{pk} = 43{,}000$ gpd

Project

$Q_A = 29.500 \text{ gpd}(1.15) = 34{,}000 \text{ gpd}$

$Q_{pk} = 43{,}000 \text{ gpd}(1.15) = 50{,}000 \text{ gpd}$

Area Available
#1 3.5 acres
#2 2.5 acres
#3 2.5 acres / 8.5 Acres

Area Required

$$A = \frac{G}{a - [\text{PPt} - \text{Evap} - \text{Seep}]} = \frac{1659090}{5 - [.53 - 6.96 - 2]} = 123{,}536 \text{ f}^2$$

= 2.5 Acres

Area available >> Area Required

Detention Time $= \dfrac{326{,}700 \text{ ft}^3 \times 7.48 \text{ G/ft}^3}{39{,}000 \text{ GPD}} = 70$ Days

(min of 30 days; ∴ okay)

Check organic loads

$\#/\text{day} = (8.34)(.035)(352) = 99 \text{ \#BOD/D}$

$\#/\text{Acre} = \dfrac{99 \text{ \#BOD/D}}{2.5 \text{ Ac}} = 40 \text{ \#BOD/A/D}$

Check Air Volume

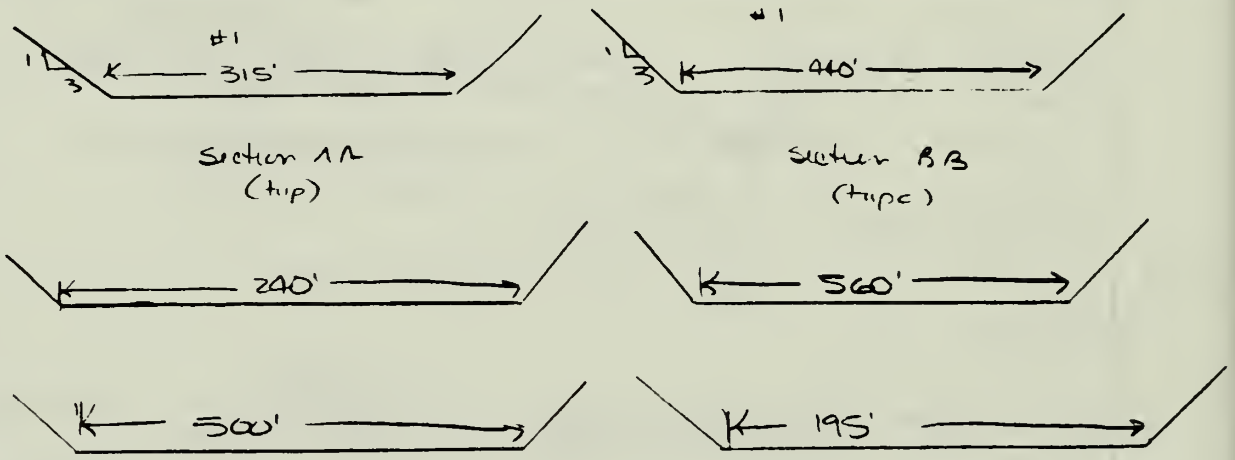
$$\frac{2(1.5 \text{ hp})}{609 - 1000 \text{ cf}} = .005 \text{ hp}/1000 \text{ cf}$$

Below - Require .5hp/1000cf

•U.S. GPO: 1984-778-378

FORM D S C - 44

Park Lake Mead Area Cottonwood Cove	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		Sheet [illegible] of
Project	By DNC	Checked	Pkg. 57
Feature Lagoon Volume	Date Jan 1987	Date	Account



$$V_1 = (315)(4)(440) + 2\left[(1/2)(4)(315)\right] + 2\left[(1/2)(4)(440)\right] = 557,$$

$$V_2 = (240)(560)(4) + 2\left[1/2(4)(560)\right] + 2\left[1/2(4)(240)\right] = 540,$$

$$V_{3\,\&\,4} = (500)(195)(4) + 2\left[1/2(4)(500)\right] + 2\left[1/2(4)(145)\right]$$

$$= 392,780\,f^3$$

•U.S. GPO: 1984-778-

FORM D S C - 44

Park lame	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 1
Area Katherine			**of** 8
Project	**By** [illegible]	**Checked**	**Pkg.** 517
Feature Population Estimates	**Date** May 89	**Date**	**Account**

	JAN 88	MARCH 88	MAY 88	JULY 88
lodge	43	66	62	80
Trailers	111	111	112	98
campgrounds	358	550	183	31
[illegible]	314	362	399	412
[illegible]	27	27	27	27
[illegible]	26	26	26	26
tot PE (ex. back.)	565	780	410	262
Est of usage per PE (2)	215	180	463	1146

use [illegible] 400 gal/person

(2) used 70% of tot water for domestic assuming 30% irrigation. Still looks like water usage excessive.

Current QAve = 230,000 gpd ≈ 160 gpm

Future Q Ave = 1.15(160 gpm) = 183 gpm

Qpump = 500 gpm ; 250 gpm

$Q_{pump\ firm} > Q_{fut\ ave}$.

Estimate annual average visitation:

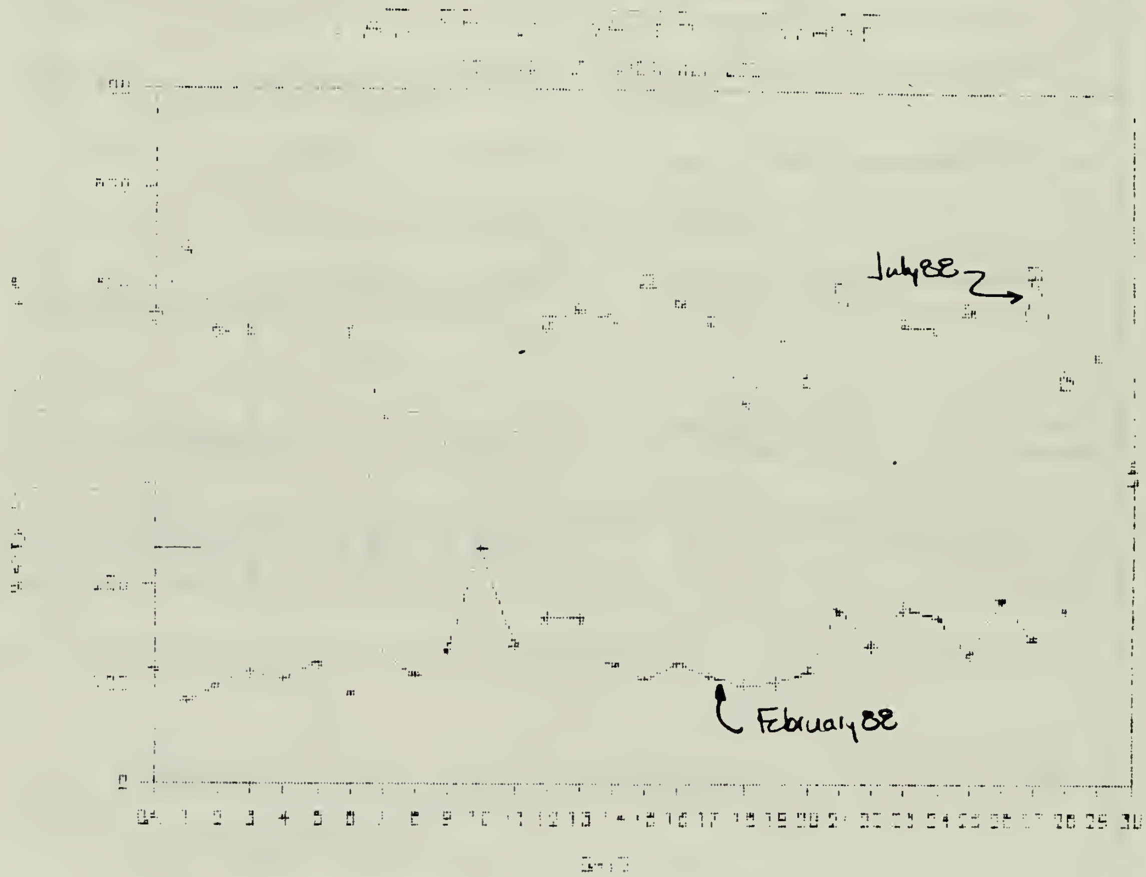
a) current = $\frac{565+780+410+262}{4}$ = 504 PE/d

b) future = 1.20(504) = 605

*U.S. GPO: 1984-778-378

FORM D S C - 44

Park Lake Mead Nat	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 2
Area Katherine			**of** 3
Project	**By** DAC	**Checked**	**Pkg.** 537
Feature Est Water Storage Req'd	**Date** May 89	**Date**	**Account**



Check max day, low month usage to estimate max day demand during non irrigation season – consider this average day annually

Q_{AVG} = 230,000 gpd

Check the peak demands during major weekends

Memorial Day	323,000 gpd
4th of July	539,000 gpd
Labor Day	316,000 gpd

Q_{PK} = 392,666 gpd say 393,000 gpd

Say 30% water goes to irrigation ∴ domestic supplied = .7(393,000) = 275,100 Gal

FORM D S C - 44

Park Lake Head	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**	**Sheet** 3
Area Katherine		**of** 8
Project	**By** DAC / **Checked**	**Pkg.** 587
Feature Review of WTX Capacity	**Date** May 1989 / **Date**	**Account**

Qpumped: Average = 176 gpm ; Peak = 298 gpm

Filter Plant:

3 filters @ 16' x 14.58' x 7'

SA/filter = 233 f²

SA/tot = 699 f²

Media = 18" Antracite and 6" sand

Clearwell: 16' x 44' x 6.5 ⇒ 34,228 Gallons

Qintake = 500 ; 250 gpm

Firm: 250 gpm < 298 gpm (peak pump) ∴ add 1-500 gpm pump

Qdesign = not provided; check filter rates

Filter rate: @ 250 gpm = 1.1 gpm/sf

@ 500 gpm = 2.1 gpm/sf

∴ filtration for at least 500 gpm acceptable.

Detention Time:

@ 250 gpm = $\frac{34,228\text{ G}}{250\text{ gpm}} \doteq 136$ mins ∴ okay

@ 500 gpm = $\frac{34,228\text{ G}}{500\text{ GPM}} = 68$ mins ∴ okay

Original installation?

upgrades: 1978 - dual media Replaced.

Storage Requirements

Domestic: 24 Average = 1.15(175 gpm x 1440) = 290,000

Fire: 2 Hrs @ 1000 GPM = 120,000

410,000

Available = 500,000 GALL

∴ $V_{available} > V_{required}$

•U.S. GPO: 1984-778-378

FORM D S C - 44

Park Lake Mead NRA	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 4
Area Katherine			**of** 8
Project	**By** DC	**Checked**	**Pkg.** 53
Feature Est Water Storage	**Date** May 89	**Date**	**Account**

$Q_{Ave}(1.5) = Q_{pk}$; usually, Check:

$1.5(230{,}000) = 345{,}000$ G

$345{,}000 > 275{,}100$

Using large value:
Estimate future water flow. Assume growth at 50% for 20 year planning period.

$1.50(345{,}000) = 517{,}500$ G

Fire Demand

Domestic. Housing 10,200 sf
Trailers 114,400 sf 40-60 ft spacing
124,600 sf

based on codes, say 750 gpm @ 2hrs

Commercial = Store/Res 6,000 sf (incl sprinkler
lodge 10,400 sf (sprinkler sys
maint 7500
23,900

say 250 gpm @ 2hrs

V_{fire} : 1000 gpm × 60 min/h × 2 h = 120 000 G

V_T = 396,800 + 120 000 ≈ 517,000

•U.S. GPO: 1984-77

FORM D S C - 44

Park Lake Mead	NATIONAL PARK SERVICE DENVER SERVICE CENTER		Sheet 5
Area Katherine			of 8
Project	By DAC	Checked	Pkg. 537
Feature Review WWTP	Date April 1989	Date	Account

Current Q: not measured

Current visitation: 504 PE/DAY Annual Average

estimate Q = 504 PE × 55 $\frac{GP}{PE \cdot D}$ = 27,720 GPD

Estimated Future Visitation = 580 PE/day, annual average
(assume 20% growth)

Estimated Q = 605 × 55 $\frac{GP}{PE \cdot D}$ = 33,264 GPD

say 35,000 GPD

Estimate Area required:

$$A = \frac{Q_{Ann}}{d - [PPt - Evap - Seep]} = \frac{35{,}000 \frac{G}{D} \times \frac{f^3}{7.48G} \times 365D}{4 - [.53 - 6.96 - 0]}$$

* currently oper. @ 4' min.
* circular pond originally constructed but has filled in over time and now acts as 2° or maturation pond

$= 163{,}748$ Ft²

$A_{reqd} = 3.76$ Acres

Area Available = 1° = (2) @ .75 Ac 1.5
2° = 1.5 1.5
(outside fenced area) 3° = 1 @ .50 Ac .5

3.5 A

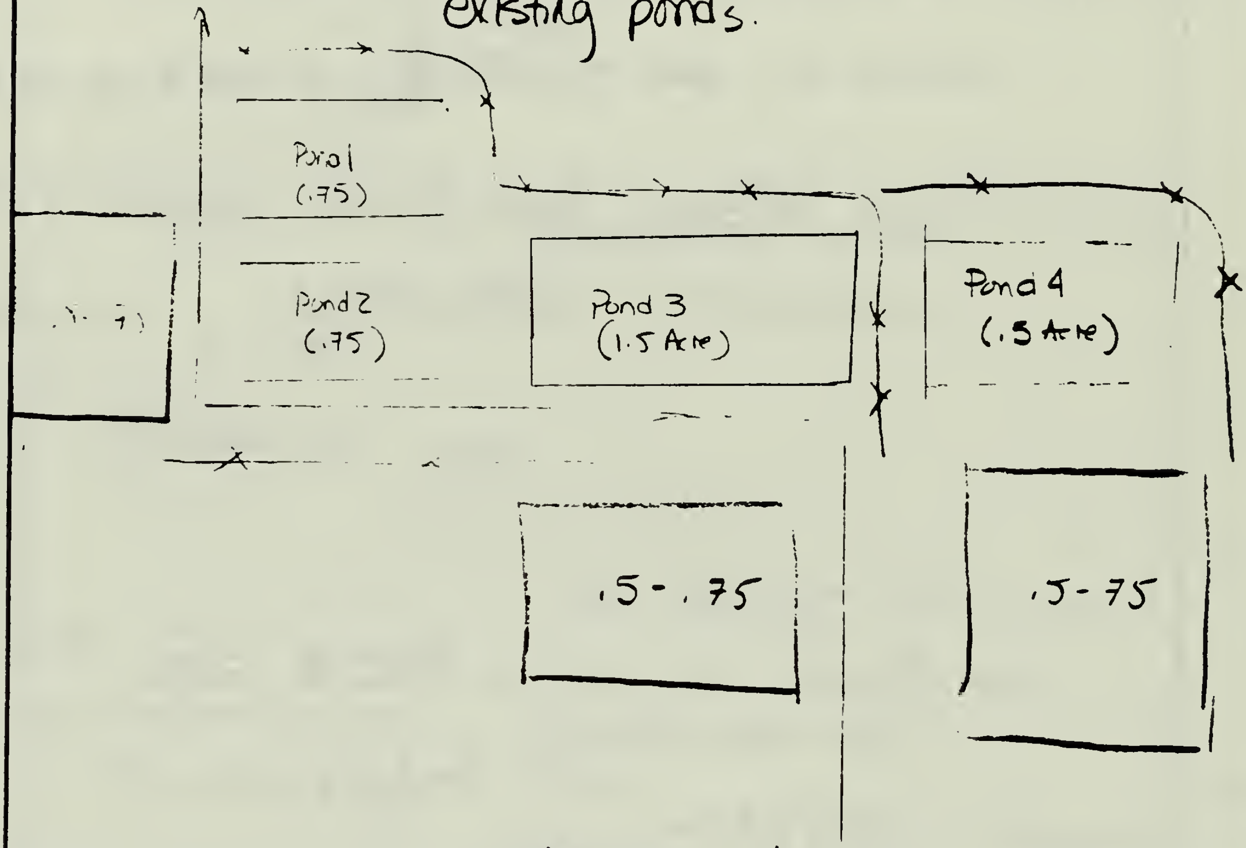
Area reqd > Area Available
3.76A > 3.5A.

*U.S. GPO: 1984-778-378

FORM D S C - 44

Park Lake Mead	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 6
Area Katherine			**of** 8
Project	**By** DAC	**Checked**	**Pkg.** 587
Feature Wastewater Tx Plt	**Date** 1984	**Date**	**Account**

Pond acreage should be expanded by .5-.75 to adequately treat [illegible] future [illegible]. Pond area could be expanded at several locations near existing ponds.



Check Detention time to determine if it meets state requirem
(in this case, use Nevada's since Arizona hasn't develope any)

$$DT = \frac{1,954,973\ G}{35,000\ GPD} = 56\ \text{Days}$$

DT available > DT required

FORM DSC-44

Park Lake Mead	NATIONAL PARK SERVICE DENVER SERVICE CENTER		Sheet 7
Area Katherine			of 8
Project	By	Checked	Pkg. 517
Feature	Date	Date	Account

Check organic loading. Since no tests have been taken at Katherine I will use a BOD concentration of 400 mg/l for estimate.

$$\text{BOD load} = (8.34)(.035)(400) = 117 \frac{\#\ \text{BOD}}{\text{day}}$$

Organic loading per acre:

$$117 \frac{\#\ \text{BOD}}{\text{day}} \times \frac{1}{1.5\ \text{Acre}} = 78\ \#/\text{acre}/\text{day}$$

Estimated organic load is excess to state std recommendation. Check if aerators provide adequate aeration.

$$\text{estimated max } O_2 \text{ demand} = 1.5 \text{ ave BOD} = 1.5(78) = 117\ \#O_2/d$$

$$= 4.9\ \#O_2/hr$$

$$N = \frac{4.9\ \#O_2/hr}{(.9)\left[\frac{6.8-2}{9.17}\right](1.025)^{28-20}} = 8.5\ \#O_2/hr$$

$$\text{Power Required} = 8.5 \frac{\#O_2}{hr} \times \frac{hp\ hr}{3.12\ lb O_2} = \underline{\underline{2.7}}\ hp$$

Power available = 4 aerator @ 2 hp = 8 hp

Power Available > Power Required ; 8 hp > 2.7 hp

∴ Okay

FORM D S C - 44

Park Lake Mead NRA	NATIONAL PARK SERVICE DENVER SERVICE CENTER			Sheet 8
Area Katherine				of 8
Project	By Deb Campbell	Checked		Pkg. 58
Feature Wastewater Tx & Disposal	Date April 1989	Date		Account

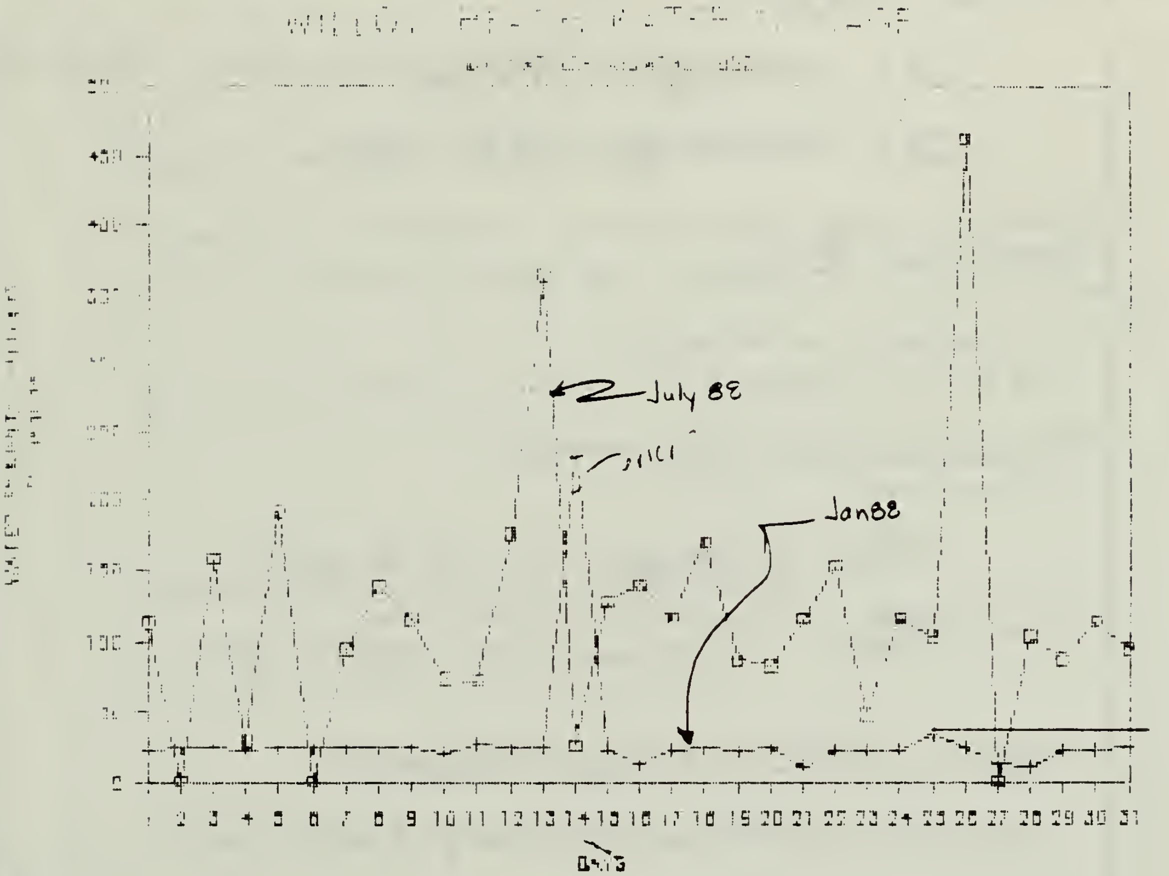
Check Air per Volume

$$= \frac{2\,(1.5\ \text{hp})}{164 - 1000\ \text{cf}} = .018\ \text{hp} / 1000\ \text{cf}$$

$.018\ \text{hp}/1000\ \text{cf} < .5\ \text{hp}/1000\ \text{cf}$ req

FORM D S C - 44

Park Lake Mead	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 1
Area Willow Beach			**of** 3
Project	**By** DAC	**Checked**	**Pkg.** 587
Feature Est Water Storage	**Date** May 89	**Date**	**Account**



Check baseline water demand during low use month. This should be essentially all domestic & commercial water demand since Park not irrigating. Assume to be average day.

$Q_A = 34{,}000$ gpd

From Pump Records

$Q_A = 66{,}300$ gpd $= 46$ gpm

$Q_{AL} = 462{,}000$ gpd $= 320$ gpm

Annual Use = 24.2 MG

FORM D S C - 44

Park Lake Mead NRA **Area** Willow Beach	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 2 **of** 3
Project	**By** DAC	**Checked**	**Pkg.** 58
Feature Water Ty	**Date** May 1989	**Date**	**Account**

PUMPING CAPACITY:

Q_A = 66,300 gpd = 46 gpm

Q_P = 462,000 gpd = 320 gpm

Q 1° pump = 300 gpm

Q = 2° pump = 250 gpm

Future Pumping Requirements

Q_A = 46 gpm = 53 gpm

Q_P = 320 gpm = 368 gpm

Both Pumps < estimate Qpeak

Recommend 1) abandon 2° pump & well house.

Relocate new well house along road to Fish Hat

Size new well > 375 gpm

2) Maintain 2° well @ the current 1° pump house

Water Storage Required (Plan to aband existg 200,000 gal tank & move out of Jimbo wash)

Water storage ⇒ domestic = 76,000

fire = 120,000

196,000

Say 200,000

•U.S. GPO: 1984-778

FORM D S C - 44

Park Lake Mead	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 3
Area Willow Beach			**of** 3
Project	**By** DAC	**Checked**	**Pkg.** 587
Feature Wastewater Tr & Disposal	**Date** April 1989	**Date**	**Account**

Estimate wastewater flows:

Qwater pumped = 66,300 gpd

Qwater to sewers = .15 (66,300 gpd) = 9,945 gpd
*based on typical usuage within park)

say 10,000

estimate Future Flows = 1.15 (9,945) = 11,436 →

say 15,000

$$\text{Area req'd} = \frac{15{,}000\text{ gpd}\ \overset{1}{\overline{(7.48)}}\ (365D)}{3-(.53-6.96-0)} = 1.8 \text{ acres}$$

need @ least .5 acres extra lagoon.

Estimate loading =

(10,000 gpd)(8.34)(300 mg/l) = 25#/d

loading = 25#/d / 0.75 acre = 33#/acre/day

DT = 550,000 G/10,000 Grn
D.T = 50 days

FORM D S C - 44

Park lame	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 1 **of** 6
Area Temple Bar			
Project	**By** D. —	**Checked**	**Pkg.** 587
Feature .	**Date** May 89	**Date**	**Account**

	JAN 88	MARCH 88	MAY 88	JULY 88
Lodge	1	50	24	56
Trailer Village	26	250	151	123
Campgrounds	7	52	86	118
Backcountry	7	17	129	151
Marina	2	10	160	72
Cabinsites	13	13	19	19
Staff	129	129	129	129
tot PE (exc back)	178	504	565	517
ind water usage	333	230	304	461

Check influent pump capacity

average domestic demand - current $Q_A = 200{,}000$ gpd = 139 gpm

future $Q_A = 1.15(139) = 160$ gpm

Check Qpump =

$Q_{\#3} = 200$ gpm. Serves as back up. No method of chlorina

$Q_{\#4} = 275$ gpm

Both Qpumps > Q_{Ave} future. Okay. No additional Q req

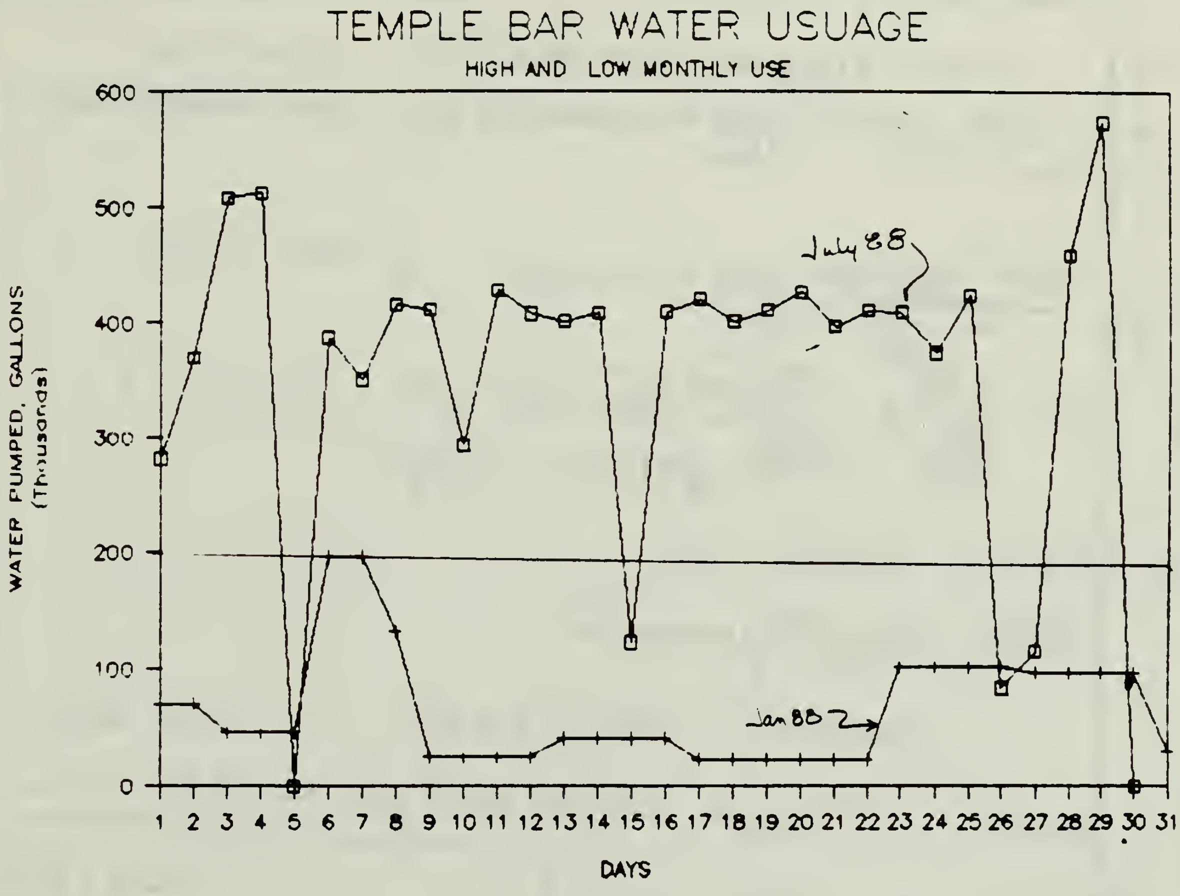
Annual Average Visitation Estimate =>

a) current = (178 + 504 + 565 + 517) ÷ 4 = 441 PE/day

b) future = 1.15(441) = [illegible] 15/day

FORM D S C - 44

Park lake Mead NRA **Area** Temple Bar	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 2 **of** 6
Project	**By** DAC	**Checked**	**Pkg.** 387
Feature Est Water Storage Equipment	**Date** May 1989	**Date**	**Account**



Check low month use, during non irrigation season, to determin
base line day use:

Q_{Ave} = 200,000 GPD (This multiplied by 1.5 equals peak)

Check against peak flow during major holiday weekends:

Memorial Day	450,000 GPD
4th July	512,000 GPD
labor Day	402,000 GPD
	1,364,000 GPD / 3 = 454,666 GPD

From Records

Average Q pump = 275,100 gpd (149)

Peak Q pump = 340,935 gpd (236 gpm)

*U.S. GPO: 1984-778-378

FORM D S C - 44

Park Lake Mead
Area Temple Bar
Project
Feature Water Tr

NATIONAL PARK SERVICE
DENVER SERVICE CENTER

By DAC
Date
Checked
Date

Sheet
of 6
Pkg. [illegible]
Account

Check Pumping Capacity

1° well @ 275 gpm > Q_{peak}

2° well @ 100 gpm < Q_{peak} (significant undersized - Replace!

Future Water Use

Q_A = 149 gpm (1.15) = 170 gpm

Q_P = 236 gpm(1.15) = 270 gpm

Water Storage Requirements

Domestic = 170gpm(1440) = 244,800

Fire = 2hrs @ 1000 gpm = 120,000

364,800 gallons

$V_{avail} > V_{required}$

•U.S. GPO: 1984-778-

FORM D S C - 44

Park Lake Mead NRA	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**	Sheet 4
Area Temple Bar		of 6
Project	By D Campbell / Checked	Pkg. 597
Feature Wastewater Tx & Disposal	Date April 1989 / Date	Account

Estimate Wastewater Flows:

Restaurant 54 seats @ 10 gpd / seat × 2 = 1080 gpd

Trailers 117 trailers @ $\frac{2 PE}{trailer} \times \frac{75 gpd}{c} \times \frac{50\% occupancy}{trailer}$ = 8,775

Staff Housing 20 units @ $\frac{3 PE}{unit} \times \frac{75 gpd}{PE}$ = 4,500

Campgrounds 153 sites × $\frac{3 PE}{site} \times \frac{25 gpd}{site}$ (75) = 8600

est. ann Q = 22,955 gpd

Estimate Flows

	Q current	Q Future
Average	23,000	26,500
Peak	92,000	106,000

Estimate Area Required

$$\frac{A}{d - [PPT - EVP - Per]} = \frac{1,293,115 ft^3}{9.5 ft} = 136,550 = 3.2 Acr$$

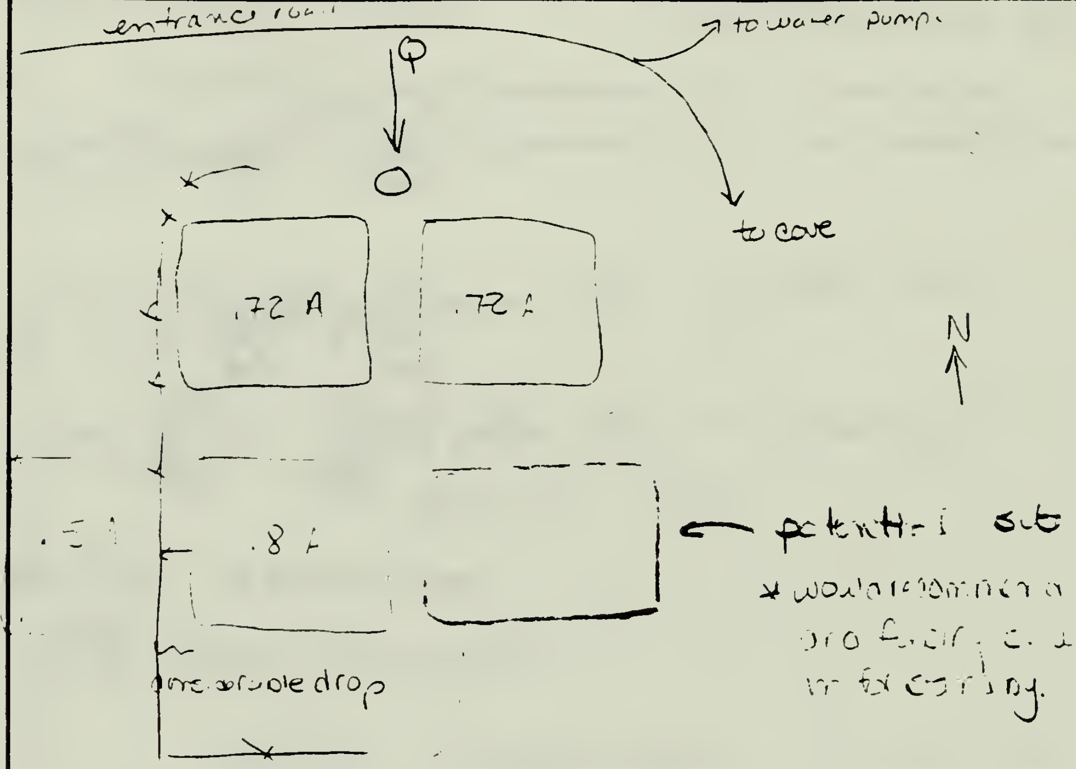
Area Available = .8 Acre (lined & aerat)
.72 Acre (lined)
.72 Acre (lined)
.5 Acre (unlined) / 2.74 Acres

Area available < Area Required → need @ least .5 Acres

•U.S. GPO: 1984-778-378

FORM D S C - 44

Park Lake Mead **Area** Temple Bar	**NATIONAL PARK SERVICE** **DENVER SERVICE CENTER**		**Sheet** 5 **of** 6
Project	**By** DAC	**Checked**	**Pkg.** 597
Feature Review of WWT	**Date** April 1984	**Date**	**Account**



* would recommend a 1.0 Acre lagoon for future, could pipe in existing.

check detention time available: Estimated V_p = 188,000 f³

$$DT = \frac{1,407,600\ G}{30,000\ GPD} = 47\ Days$$ – looks good

Check on organic loading, assume BOD = @ 300 mg/l

$$BOD\ load = 8.34(.030)(\overset{350}{\cancel{300}}) = \overset{88}{\cancel{75}}\ \#\ BOD/day$$

$$estimated\ loading - 1\ pond = \frac{\overset{88}{\cancel{75}}\ \#\ BOD}{.72\ Ac - D} = \overset{121}{\cancel{104}}\ \#/A$$

Determine if adequate O_2 is provided by aeration for loading:

$$est\ O_2 = 1.5(ave\ BOD\ load) = 1.5(75) = 113\#/D = 5\#/hr$$

FORM D S C - 44

Park Lake Mead NRA	NATIONAL PARK SERVICE DENVER SERVICE CENTER		Sheet 6
Area Temple Bar			of 6
Project	By D.T.C	Checked	Pkg. 592
Feature Review of wwt	Date April 1984	Date	Account

$$N = \frac{N_a}{\alpha\left[\frac{C_{sw} - C_L}{C_s}\right] 1.025^{T_w - 20}} = \frac{5.7\ O_2\ hr}{.9\left(\frac{6.3 - 2}{9.17}\right)(1.025)^{22-20}}$$

$$= 8.71\ lb\ O_2/hr \text{ required}$$

$$\left\langle \text{aerators available} = 3 @ 2\ hp = 6\ hp \right\rangle$$

$$\text{Power required} = \frac{8.71\ lb\ O_2}{hr} \times \frac{hp\ hr}{3.12\ lb\ O_2} = 2.8\ hp$$

Power available > Power Req'd => $6 > 2.8$ ∴ okay

•U.S. GPO: 1984-778-378

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APPENDIX E

ACKNOWLEDGEMENTS

Alan O'Neill, Lake Mead NRA (LAME) Superintendent
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Sam Smith , Overton District Operator
Butch Smith, Overton District Operator
John Herrman, Mohave District Foreman
Chuch Henry, Mohave District Operator
Curtis Lewis, Mohave District Operator
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NPS-D117